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## ABSTRACT

Prepared to serve the 2-year college administrator and faculty member in becoming acquainted with the coal mining industry and in developing degree and nondegree programs in mining technology, this report provides descriptions of the mining industry, organization of labor, job descriptions, types and methods of coal mining, certification requirements, and processes toward establishing technical and advisory assistance. (Information about the mining industry for this study was obtained from educational institutions currently offering mining programs, labor unions, regulatory agencies, coal operators, mining equipment manufacturers, and research concerns who have dealt with mining education.) A general outline of the methods of bituminous coal mining currently in use are presented, along with the labor structure inherent in each method. Proposed curricula are included for consideration by educational institutions wanting to develop mining technology programs or offer special related courses. Recommendations for the composition of an advisory council, a list of agencies to be contacted during the planning and implementation of mining courses, and a partial listing of textbooks are also included. (MF)

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ED141601

## MINING TECHNOLOGY

### An Assessment Study for Educational Institutions Potential Involvement in Servicing the Mining Industry

U.S. DEPARTMENT OF HEALTH,  
EDUCATION & WELFARE  
NATIONAL INSTITUTE OF  
EDUCATION

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Westmoreland County Community College  
Youngwood, PA 15697  
September, 1976  
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Project: 11-5831  
Bureau of Vocational Education  
Pennsylvania Department of Education  
Harrisburg, PA 17126

CE 011 701

In October, 1975, Westmoreland County Community College received a federally funded Post-Secondary Vocational Education Grant through the Pennsylvania Department of Education's Division of Two Year Programs to assess the two year college's role in Mining Technology Training. During the eight month project period, Westmoreland County Community College attempted to involve a wide representation of local, state, and federal public agencies and the direct and supporting industries in the development of a mining technology assessment report.

The College has also developed an extensive file of supporting documents, texts, referrals, and journals to complement each section of the major report publication. This report and the supporting information is designed to serve the two year college administrator and faculty member in becoming acquainted with the mining field and assisting in the establishment of a framework for the decisions to be made in considering the development of non-degree and degree programs in the mining field.

The publication orients the reader by providing a comprehensive description of the mining field including an organization of labor, job description, descriptions of types and methods of mining, certification requirements, processes toward establishing non-degree or degree programs, locating proper supporting materials, and establishing area technical and advisory assistance. The value of this publication will be determined by the extent to which two year college planners, administrative leaders, and faculty are interested in serving the mining field. This value may not be assessed until the mining industry and supporting government agencies establish clear projection of the manpower needs, upgrade skill and knowledge requirements, and apply the nation's investment in coal as a future major energy supply resource. These assessments are both critical and controversial in that the political, industrial, and community service agencies are in disagreement on future projections, yet at the same time are attentive to the issues as critical issues in light of previous experiences with an energy shortage. This publication does not attempt to take a position in these areas due to the everchanging analysis, the controversy among organizations better equipped to assess future needs, and our limited time and funds. However, the publication's value should increase in direct proportion to the actual energy shortage that might occur in the future. The two year college and related vocational institutions should be best equipped to serve the technical training needs of the mining industry; and, this publication is our attempt to assist in that service preparation.

Representatives are available at Westmoreland County Community College to offer assistance beyond the information contained within this publication.

Robert Alan Meeder  
Development Officer  
Westmoreland County Community College  
Youngwood, Pennsylvania 15697

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I would like to acknowledge the assistance of George Smail, Media Specialist Westmoreland County Community College, in the research and review process for this report.

I also wish to thank all persons contacted during my research for their cooperation and interest; special thanks to Mears Coal Company for permitting me to observe actual underground mining.

## CHAPTER ONE INTRODUCTION

### PURPOSE

This report is written for the community college educator who has an interest in, but no knowledge of, the coal mining industry. It will provide a general outline of the methods of bituminous coal mining currently in use, and the labor structure inherent in each method. Model curricula are presented for consideration by educational institutions which want to develop mining technology programs or offer special mining related courses.

Recommendations for the composition of an advisory council and sources for access to the appropriate persons are presented.

A list of agencies to be contacted during the planning and implementation of mining courses is provided, as is a partial listing of textbooks identified as relevant to mining education.

### OBJECTIVES

It is important to understand at the outset the relevance of mining today.

Fossil fuels are of primary importance to the United States, not only in terms of power production but also in industry. With the increased emphasis on United States energy self-sufficiency, fossil fuels are regarded as the primary source of energy in the foreseeable future. A breakdown of fossil fuels indicates that the U.S. has coal reserves (materials which are known to exist in a form which can be economically recovered with current technology) which will last five hundred years, even at the projected production increases. Domestic oil and gas reserves will last about twelve years.

In Pennsylvania, for example, coal reserves amount to approximately twenty four billion tons bituminous coal, and seven billion tons anthracite coal. Coal resources, material which exists but cannot be economically recovered by today's technology, amount to seventy billion tons bituminous and twenty billion tons anthracite.

Coal production in Pennsylvania is expected to increase from eighty six million tons per year in 1974 to one hundred million tons in 1980. If production levels such as these are to be realized, the manpower situation of the industry must be closely scrutinized by the educational institutions in our country.

...in order to increase coal production it is necessary to hire more young, inexperienced men. These employees are less productive and have relatively less safe work habits than experienced miners thus leading to the need for even more men... 1

Projections for the nationwide increase in coal production are based on important variables. Among those are the application and/or development of the technology needed to burn coal and to meet federal and local clean air standards.

Another important factor is the national priority placed on energy self-sufficiency. Coal users and producers will need to know if regulations will permit use of coal for future plant expansions before they will invest in the required utilization, transportation or mining facilities.

Along with the projected increase in coal production necessitating new manpower, it is important to look at the history of the mining industry in terms of the labor force. Briefly, because coal production slackened during the 1950's, few new employees entered the mining industry. The effect of this has been a bimodal distribution of the ages of mine employees.

...it is interesting to note that the mining labor force (including supervisors) consists mainly of men who are either in their 20's or their 50's. The reason for this is that during the 50's and 60's the coal business was in a recession and few new miners entered the industry... 1

With the current United Mine Workers of America (UMWA) contract, 1974, it is possible for individuals to retire at age fifty five. Because of the lowered retirement age, an influx of new individuals into mining will occur within the next eight to ten years.

There have been many technical improvements in mining methods and in mining machinery within the past forty years. These improvements have required that miners become more knowledgeable in the repair and operation of equipment. A popular expression in the industry is that "the days of strong backs and weak minds are over; equipment now does the heavy work."

Efficient and well-trained maintenance men, equipment operators, and supervisory personnel are required to optimize production. The contract with the UMWA requires that certain training be provided to the workers, and legislation being considered at state and federal levels may make more training mandatory. West Virginia, for example, requires mandatory eighty hour pre-employment training courses (see Pre-Employment Training, Chapter Seven.)

The labor requirements of mining, hence the mining needs, are directly dependent on a national energy self-sufficiency policy for and the desire to utilize domestic fuel for power and industry. The adoption of a national energy policy, along with the technical developments that enable the removal of high sulfur emissions caused by the burning of coal, will directly affect the needed production of coal.

### METHOD

To obtain information about the mining industry, six major concerns were contacted in this study. The following contacts provided input:

1. Educational institutions - colleges, community colleges, vo-tech schools, extension programs currently offering mining programs.

<sup>1</sup>Coal for the 70's: A Pennsylvania Action Conference. (Harrisburg, PA; Conference Proceedings; Task Force; Reports & Background Data; April 24, 1974)

2. Labor - primarily represented by the UMWA.
3. Regulatory agencies - Federal; Mine Enforcement and Safety Administration; and State; Pennsylvania Office of Deep Mine Safety.
4. Coal operators - both individually and through national organizations such as the Bituminous Coal Operators Association (BCOA).
5. Mining equipment manufacturers - for example, Joy Manufacturing, Jeffrey Dresser, Lee-Norse, Caterpillar, National Mine Service Company.
6. Research concerns who have dealt with mining, education; McDonald Douglas, Bendix, and Batelle.

Contacts were initiated with the above groups; and information and recommendations were obtained as to their interest in, and requirements for, mining education at the two-year level. In addition, a computer search of the ERIC (Educational Resources Information Center) files was initiated to locate literature and educational materials to assist in the study. Periodicals dealing with mining were identified and surveyed for articles dealing with manpower training needs.

## CHAPTER TWO GENERAL DESCRIPTION

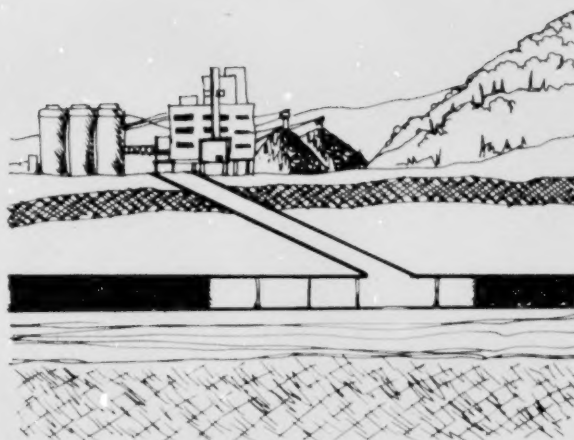
### INTRODUCTION

In order for an educator to become involved in planning a training program, or even in the formulation of an advisory committee, it is beneficial to have a basic understanding of the industry. The objective of this section will be to provide a simplified general introduction to the four common types of bituminous coal mining. Detailed information can be obtained by consulting the many sources found in the resource listing included in chapter eight of this report.

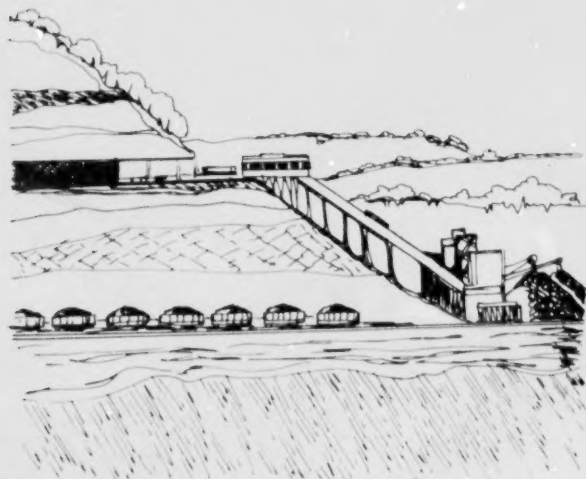
### DEEP MINING

The three types of mines are slope, draft and shaft. 'Type' is used here to denote how the coal seam is accessed. A drift mine is one where mining proceeds horizontally, directly into a seam outcropping. A slope mine is constructed at an angle down into the coal seam. This type of mining permits men and equipment to be taken in and coal hauled out either by rail, belt or battery operated transportation equipment.

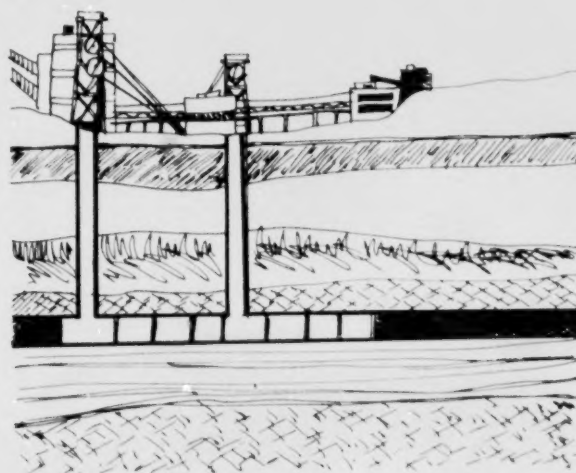
The third type of mine construction is a shaft mine. The shaft is bored vertically into the coal seam and a hoist (elevator) is used to transport supplies in and coal out. Frequently a mine will be a combination of these constructions. A slope may be used to haul supplies in and coal out; men may use a shaft to access the mine.



SLOPE MINE



DRIFT MINE



SHAFT MINE

ILLUSTRATION 1 Types of Mining

## METHODS

Irrespective of the type of mine, three methods of mining may be used. They are room and pillar, long wall, and short wall.

Room and pillar mining is a system which leaves a catacomb of passages and blocks (pillars) of coal. Parallel entries are driven into the coal seam, and crosscuts are made at right angles to those entries. Depending on the type of mining equipment used, there will be two to five or more entries being cyclically developed by one group of men. This working group is said to be working a "section." A mine can have one or more sections working simultaneously.

Generally, deep coal mines are the height of the coal seam being mined. Different seams commonly vary between two and eight feet, however some may be as high as twenty-five feet. Coal seams above forty two inches thick are commonly referred to as "high" coal; thinner seams are called low coal.

All deep mining equipment is constructed for specific seam thickness. Shuttle cars, for example, vary in capacity according to how high they are.

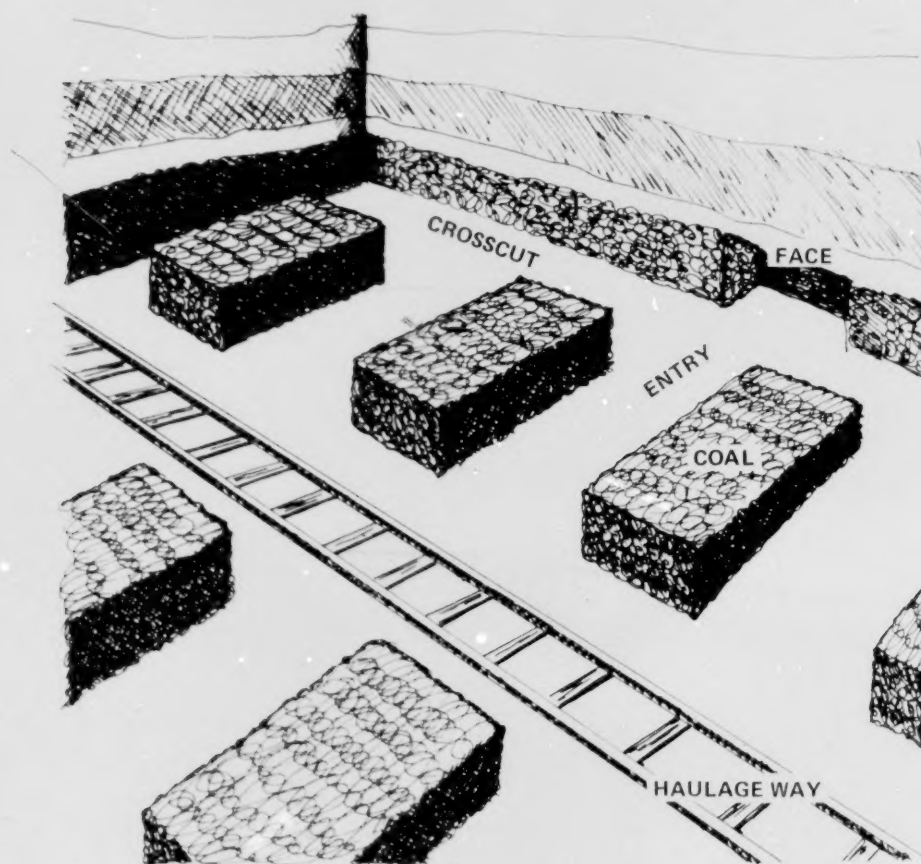


ILLUSTRATION 2 Room and Pillar Mining

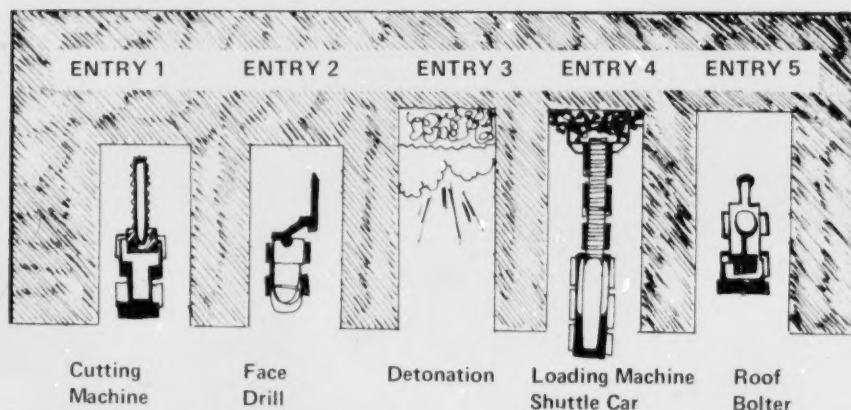


Figure 1

A conventional mining section is most efficient when five or more entries are developed simultaneously. When the machine's job has been performed in its current entry, Figure 1, the machinery is moved to the next entry, Figure 2.

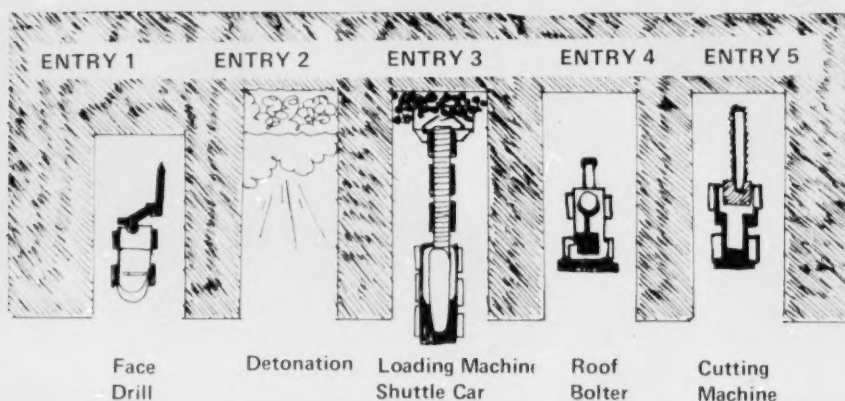


Figure 2

### ILLUSTRATION 3 Conventional Mining Cycle

#### ROOM AND PILLAR MINING

A room and pillar construction may be mined with conventional mining equipment or by continuous mining. Conventional mining requires the most simultaneous entry development for maximum production. The steps and machines used in conventional mining are as follows:

1. The coal at the working place (called the face) is undercut using an electrically powered rubber tired cutting machine. This machine has a chain saw like bar mounted on the front which the operator can swing from right to left to cut a six inch high, six foot deep slot at the bottom of the face.
2. A drill is brought to the working face, usually electrically operated, and holes are drilled into the coal.
3. Explosive charges are placed then detonated. The undercut made in the first step enables the force of the explosion to break the coal free.
4. A loading machine is moved (trammed) to the fallen coal at the face. This caterpillar-mounted machine has gathering arms on the front and scoops the coal onto the conveyor-part of the loading machine. Under the back end of the loading machine is parked a rubber-tired electrically operated shuttle car (buggy). After the shuttle car has been loaded with coal, the operator drives to an unloading point from which the coal is taken to the mine mouth (porthole). Usually, each section has two shuttle cars so that one is available to receive the coal while the other is in transit to the main haulage way.
5. After the coal is loaded and the loading machine removed, a roof-bolting machine is brought to the face. Roof bolting is the method most used to hold the roof (top) in place. The roof-bolter, like most mining equipment, is electrically operated. It is essentially a vertical drill which is used to drill the

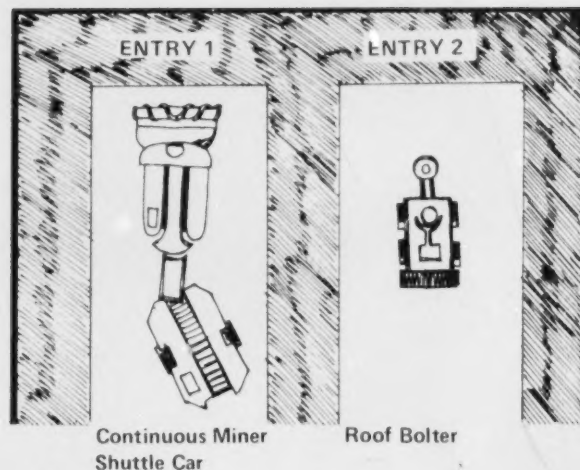


Figure 1

A continuous mining section can consist of two entries. The continuous miner cuts coal until the operator is approaching an unsupported roof, Figure 1. Then the miner is moved to Entry 2 while the roof bolter secures the roof in Entry 1, Figure 2.

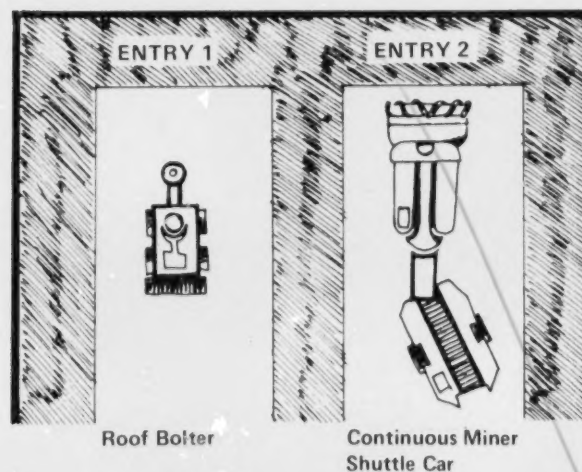


Figure 2

#### ILLUSTRATION 4 Continuous Mining Cycle

hole and to install the steel roof bolt. The bolt serves either to suspend the mine roof from solid material above, or to laminate several layers of strata together to keep the roof solid.

6. After the roof is secure, a rock-dusting machine is brought in. This machine is used to spray rock dust on the roof and walls (ribs) of the mined area to minimize coal dust.

If a conventional mining section were mined using only one or two entries, most of the machines and their operators would be idle at any given time. This is why several entries are developed simultaneously.

Continuous mining combines many conventional operations to effect, as the name implies, almost continuous mining. (Illustration 4) The procedure and equipment used are as follows:

1. A continuous miner is trammed to the working

face. This electrically-powered caterpillar-mounted machine has a rotary cutter head mounted on a loading machine type frame. The operator raises the cutting head to the roof, or the top of the coal seam, and trams the machine forward, allowing the cutter to sump into the coal. The cutter drum is then hydraulically forced down, cutting coal as it goes. When the coal falls to the floor (bottom), the gathering arms on the continuous miner move the coal to the conveyor which dumps it into a waiting shuttle car. The continuous miner can advance until the operator is nearing an unsupported, unbolted roof.

2. The continuous miner is moved to another entry while a roof bolter, as described in number 5 above, secures the roof.
3. Rock dusting, as above, is then done.

A continuous mining section then requires less equipment and fewer entries than does a conventional mining section.

The primary disadvantages of room and pillar mining is that approximately 45% of the coal is left in the mine in pillars. When the mining has advanced as far into the seam as planned, pillars can be removed when the equipment is in retreat. This procedure is known as pillaring, and enables pillar and room mining to recover a high percentage of coal.

#### LONG WALL MINING

Long wall mining, developed in Europe, and which is gaining widespread usage in the United States, can be used when the coal seam is of a uniform thickness and of a constant pitch. It differs from room and pillar methods in that coal is usually mined on the retreat, moving out of the seam.

Entries are driven into the coal by conventional or continuous mining methods. Two hundred to five hundred feet away parallel entries are driven. When these entries are connected the working face is formed. (Illustration by

Hydraulic roof supports (chocks) are installed the length of the face. These supports have a conveyor attached to them and are hydraulically self-advancing. A cutting machine of the plow or rotary type moves across the face, cutting the coal and allowing it to fall into the conveyor, which parallels the face. As the plow passes a given point, the chocks move forward toward the face, pushing the conveying system in front of it. When the shearing machine reaches the end of the working face it reverses its direction and moves back across the face.

The long wall method allows the roof behind the chocks to fall, creating an area of fallen strata called gob. The advantages of the long wall mining method are high productivity, good ventilation characteristics, and assurance that the miners are always under positive roof support.

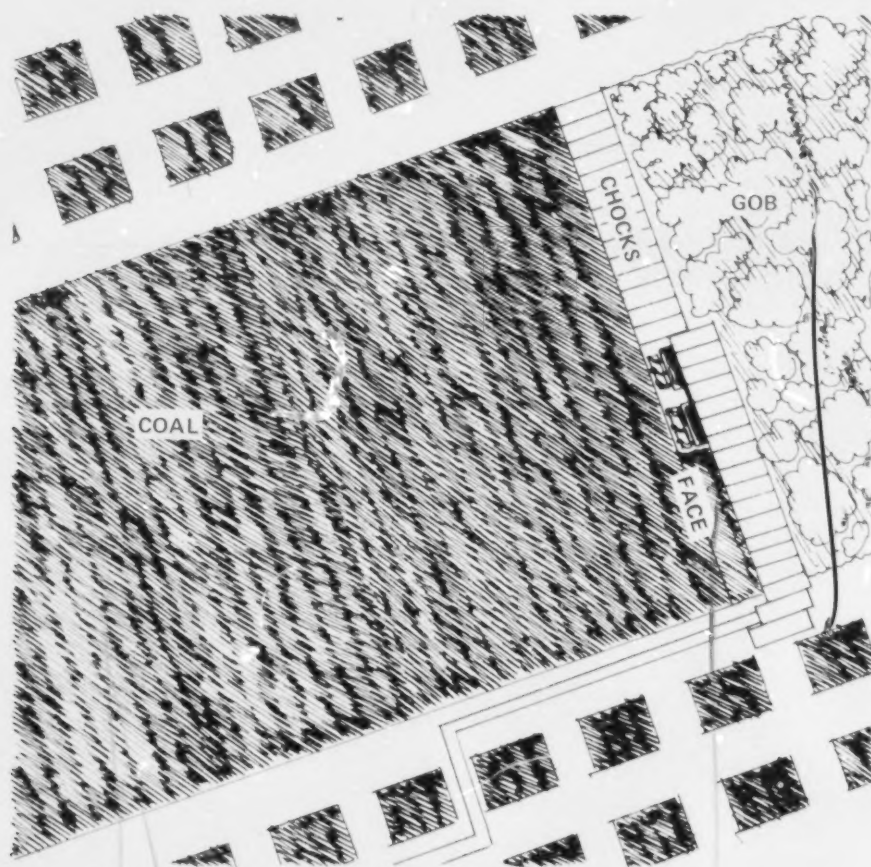


ILLUSTRATION 5 Long Wall Mining

### SHORT WALL MINING

Short wall mining is very similar to long wall mining. In short wall mining, the working face is not as long, however, self-advancing roof supports are used. A continuous miner, rather than the shearing machine used in long wall mining, is used to cut and load the coal. Short wall mining is, therefore, a hybrid of continuous mining and long wall mining.

### SURFACE MINING

The two surface mining techniques in use are strip and auger mining, the latter often used in conjunction with the former.

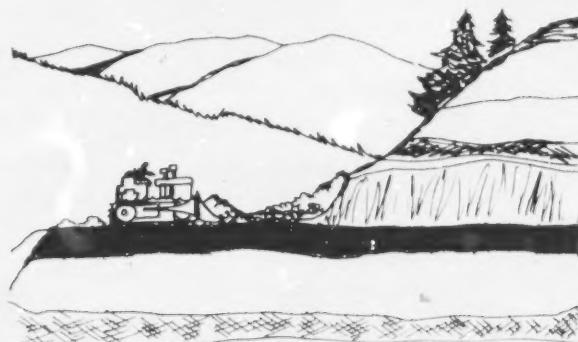
Basically, strip mining is the removal of dirt and rock overburden from the coal seam being mined. The coal is scooped out using a shovel or front end loader and/or other large volume excavation equipment. (Illustration 6)

Large volumes of coal with almost 100% recovery can be achieved using strip mining methods. The major economic factor used to determine the feasibility of stripping a coal seam is the ratio of overburden thickness to seam thickness. Ratios of one to ten and one to fifteen used to be strictly observed; one inch of coal to every foot of overburden. With today's demand for high BTU coal or low sulfur metallurgical coal these ratios can be economically exceeded.

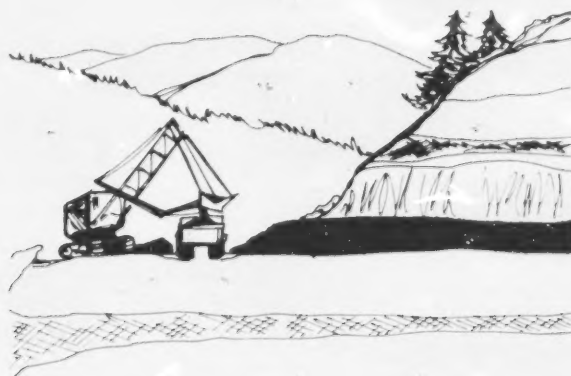
Auger mining is often used when the overburden in a strip operation has become too high to remove. Large augers bore into the coal at the high wall to recover as much coal as possible before back filling.



ORIGINAL LAND CONTOUR



REMOVAL OF OVERBURDEN



COAL LOADING

ILLUSTRATION 6 Surface Mining

## CHAPTER THREE LABOR STRUCTURE

### INTRODUCTION

Now that a general description of the methods used for coal mining has been presented, closer attention will be given to the labor structure. Most of the state and federal regulations that deal with requirements and training are directed toward deep mining positions. The UMWA contract deals with both deep and surface strip mining.

The major documents to be considered in a discussion of mining education are as follows:

1. The Code of Federal Regulations - Title 30 Mineral

Resources.

2. National Bituminous Coal Wage Agreement of 1974 (United Mine Workers of America Contract).
3. Individual State Bituminous Coal Mining Laws for Underground and Surface Mines.

Each document sets rules and regulations about requirements for various job classifications.

### JOB TYPES

Because the job of mining coal is done by several different methods (Chapter Two), the employment classifications are somewhat varied. (Illustration 7)

### ORGANIZATION OF MINE

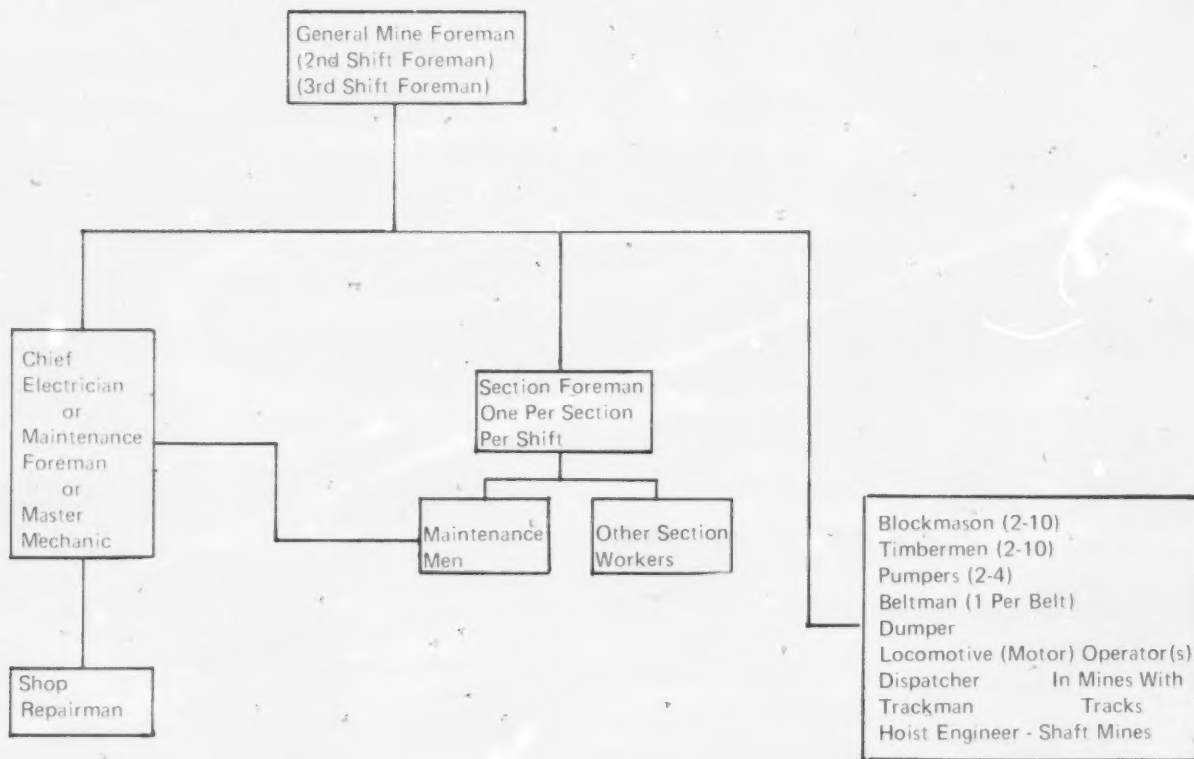
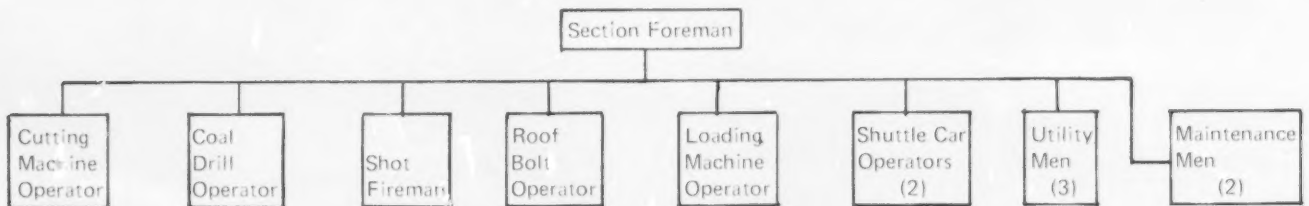
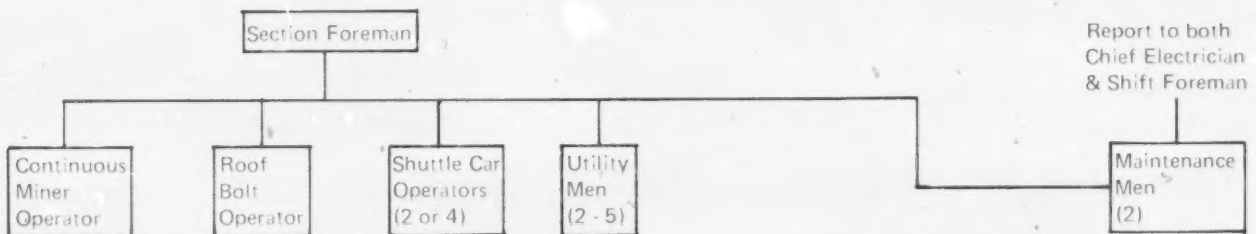


ILLUSTRATION 7

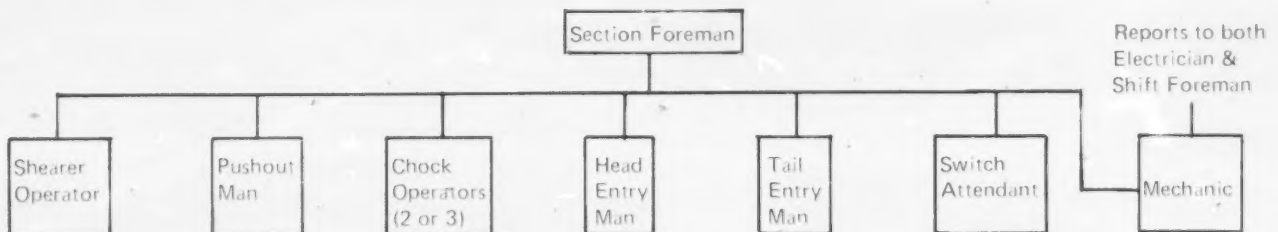
### CONVENTIONAL MINE SECTION



### CONTINUOUS MINER SECTION



### LONGWALL SECTION



Certain jobs require a specified length of experience, some also require that an individual be "certified" and/or "qualified." When these terms are used in the context of coal mining, it is important to draw a distinction between them. A certified person is one who has satisfied certain state requirements to enable him to perform certain jobs. A qualified person is one who is permitted to do certain jobs because he has satisfied federal requirements. The two terms are not mutually exclusive. However, the code of federal regulations states that certain persons are recognized as qualified, some are not. By meeting the federal requirements an individual may become "qualified" in those areas.

The following list will serve to acquaint the reader with the qualification, certification, and contractual requirements for most of the labor and first line supervisory jobs. References to Pennsylvania State Law are made as an example for discussion purposes. Note that each state has its own certification requirements. This list, of course, should be viewed with some reservation as both state and federal regulations are (constantly) pending revision. When revision occurs, it is likely to entail (more) pre-employment training requirements and more extensive yearly retraining for all personnel.

In this chapter and throughout this report the masculine pronoun refers to both men and women.

#### **MINE FOREMAN**

A mine foreman must be certified by the state. Pennsylvania State Law requires him to be a U.S. citizen at least twenty three years old and have five years of underground mining experience with at least three of those years spent within a working section (within one thousand feet of the working face). The Bituminous Coal Mining Laws of Pennsylvania for Underground Mines also make this provision:

...that graduates (in the coal mining course of a recognized institution of learning) with a bachelors degree in civil engineering, electrical engineering or mining engineering, or an associate degree in the mining engineering course of a recognized institution of learning may, after examination, be granted certificates of qualification by an examining board, its mine foremen and mine electricians, (and mine examiners) if possessed of an aggregate of not less than three years practical experience as miners or men of general work or mining engineers...

As illustrated in Figure Seven, the mine foreman, or general foreman oversees the operation of the entire mine. Because of his state certification, the foreman is considered to be qualified by the federal government to the extent of his certification.

#### **SECTION FOREMAN**

To hold the job of section foreman an individual must be certified as a mine foreman or an assistant mine foreman. The requirements to become certified as an assistant mine foreman are the same as those of a mine foreman with the following exception: the applicant needs four years inside experience, with three years on working sections. The

educational provisions as previously quoted, however, apply making it possible for a miner with three years experience and appropriate educational credentials to apply for certification. The test given for assistant mine foreman is often the same as that given for mine foreman. The assistant foreman applicant is not required to achieve as high a percentage on the test as is a mine foreman.

#### **MINE EXAMINER**

A mine examiner, or "fire boss" as he is commonly called, must be certified. He must have three years experience in working sections of bituminous coal mines. He must also be twenty three years old and a U.S. citizen. He must have had experience in gassy mines and have been instructed in the use and mechanics of all gas detection devices.

The mine examiner usually is the individual responsible for taking methane (gas) readings in the mines, and assuring that all working areas of the mine are safe. He, too, is qualified on the basis of his state certification and takes measurements which are required by federal law to be made by qualified persons.

#### **MINE ELECTRICIAN**

This is the job title which leads to much confusion. To become a certified electrician in Pennsylvania, for example, an individual must be a citizen, be twenty three years old, have worked three years in working sections, and had experience in gassy mines. He must have received instruction in the use and maintenance of gas detection devices. Candidates must pass a mine electrician's examination.

In Pennsylvania each mine using electricity underground is required to employ a qualified electrician. If that mine is considered by the state to be gassy the electrician must be certified. Federal law requires that all maintenance on electrical equipment be performed by a qualified individual.

In some states certified electricians are considered to be qualified without federal instruction or testing. Pennsylvania's certified electricians, however, are not automatically approved by the federal government as being qualified.

To become qualified as an electrician the applicant must have had at least one year of experience in performing electrical work, either in a coal mine or in any industry using or manufacturing similar equipment. He must also attend an eighty hour coal mine electrical training program approved by the Mine Enforcement and Safety Administration (MESA) and taught by a MESA approved instructor.

After becoming qualified, an individual must satisfactorily complete an approved coal mine electricians retraining program yearly. It is common in Pennsylvania for a mine to have several qualified individuals and perhaps only one certified. The Pennsylvania State Law requires that the mine electrician "...shall have full charge of the electrical apparatus in the mine, but shall be subject to the authority of the mine foreman." An individual fulfilling the function of mine electrician is often the maintenance foreman, supervising the maintenance crews and also maintenance men on working sections.

#### **HOISTING ENGINEER**

The person who operates the electric or steam driven hoist in a shaft mine must be qualified by federal regulations. The requirement for qualification is basically one year's

experience working as a hoist operator. Pennsylvania is considering the adoption of certification requirements for hoist operators.

#### MINER

As one is sure to realize at this point the term miner entails many job classifications. To work as a miner an individual must have a certificate issued by the state. A certified miner is said to have his "papers." Pennsylvania defines the term miner for the purpose of specifying who is required to be certified as follows:

...Only underground workers in bituminous coal mines who cut, drill, blast, or load coal or rock at the face of an entry, room, pillar, or other working place, or workers who do general work; also timbermen and trackmen whose duties require them to set timbers and lay or repair tracks at the working faces, and motormen, and shuttle car operators, except as hereinafter provided...

...Supervisory and technically trained employees of the operator whose work contributes only indirectly to mine operations, employees who are not performing the work of a miner as that term

is defined (above) in this act, and noncertified miners, shall not be required to possess a miner's certificate...

When an individual is employed by a coal company in a UMW mine, he first undergoes a training program lasting at least four days. The fourteen elements taught are outlined in the National Bituminous Coal Wage Agreement of 1974.

After this four-day orientation program the employee is classified as a trainee and is permitted to work in the mine. However, the trainee may not work on or operate any mining equipment or work with medium (301 to 650 volts) or high voltage (more than 650 volts) electricity. He must be within sight and sound of another employee for ninety (working) days, then after the ninety day trainee period the UMW contract permits him to bid on any job which arises.

Each state establishes the length of experience required for a trainee to become a certified miner. Pennsylvania requires one year of experience before an individual can obtain his miner's papers. During this year, the new employee must work under the direction of a certified miner.

Because seniority is considered in the awarding of jobs an employee is often not able to advance to a new job for one or two years after employment. The employment classifications for each pay grade are listed in Table 1, 2, and 3 (These figures may be updated by contacting the United Mine Workers of America.)

TABLE 1

#### UNDERGROUND AT DEEP MINES

##### GRADE 5

DAILY WAGE RATE: 12/6/76 \$58.92/day

CLASSIFICATIONS: A. Continuous Mining Machine Operator  
B. Electrician  
C. Mechanic  
D. Fireboss

E. Longwall Machine Operator  
F. Welder, First Class  
G. Roof Bolter

##### GRADE 4

DAILY WAGE RATE: 12/6/76 \$55.68/day

CLASSIFICATIONS: A. Cutting Machine Operator  
B. Dispatcher  
C. Loading Machine Operator  
D. Machine Operator Helper  
E. General Inside Repairman & Welder

F. Rock Driller  
G. Continuous Miner  
Helper-Trainee  
H. Roof Bolter  
Helper-Trainee  
I. Maintenance Trainee  
(max. 12 mos.)  
J. Electrician Trainee  
(max. 12 mos.)

##### GRADE 3

DAILY WAGE RATE: 12/6/76 \$52.74/day

CLASSIFICATIONS: A. Driller-Coal  
B. Shooter  
C. Precision Mason-Construction

D. Faceman  
E. Dumper  
F. Shuttle Car Operator

##### GRADE 2

DAILY WAGE RATE: 12/6/76 \$50.96/day

CLASSIFICATIONS: A. Motorman  
B. Maintenance Trainee (Max. 6 mos.)  
C. Electrician Trainee (max. 6 mos.)

D. Electrician Helper  
E. Mechanic Helper

**GRADE 1**

DAILY WAGE RATE: 12/6/76 \$50.38/day

## CLASSIFICATIONS:

- |                         |                    |
|-------------------------|--------------------|
| A. Beltman              | G. Pumper          |
| B. Bonder               | H. Timberman       |
| C. Brakeman             | I. Trackman        |
| D. Bratticeman          | J. Wireman         |
| E. General Inside Labor | K. Labor-Unskilled |
| F. Mason                |                    |

TABLE 2

## STRIP AND AUGER MINES

**GRADE 5**

DAILY WAGE RATE: 12/6/76 \$58.92/day

## CLASSIFICATIONS:

- |                                 |                       |
|---------------------------------|-----------------------|
| A. Coal Loading Shovel Operator | C. Master Electrician |
| B. Overburden Stripping Machine |                       |

**GRADE 4**

DAILY WAGE RATE: 12/6/76 \$54.20/day

## CLASSIFICATIONS:

- |                |                            |
|----------------|----------------------------|
| A. Electrician | D. Welder, First Class     |
| B. Machinist   | E. Shovel & Dragline Oiler |
| C. Mechanic    | F. Groundman               |

**GRADE 3**

DAILY WAGE RATE: 12/6/76 \$51.56/day

## CLASSIFICATIONS:

- |                                  |                                          |
|----------------------------------|------------------------------------------|
| A. Mobile Equipment Operator     | E. Driller & Shooter                     |
| B. Repairman                     | F. Maintenance Trainee<br>(max. 12 mos.) |
| C. Stationary Equipment Operator | G. Electrician Trainee<br>(max. 12 mos.) |
| D. Welder                        |                                          |

**GRADE 2**

DAILY WAGE RATE: 12/6/76 \$49.49/day

## CLASSIFICATIONS:

- |                       |                                         |
|-----------------------|-----------------------------------------|
| A. Tipple Attendant   | F. Deck Hand, Boat                      |
| B. Electrician Helper | G. Dock Hand                            |
| C. Mechanic Helper    | H. Maintenance Trainee<br>(max. 6 mos.) |
| D. Machinist Helper   | I. Electrician Trainee<br>(max. 6 mos.) |
| E. Repairman Helper   |                                         |

**GRADE 1**

DAILY WAGE RATE: 12/6/76 \$48.90/day

## CLASSIFICATIONS:

- |                |                         |
|----------------|-------------------------|
| A. Car Dropper | E. Truck Driver Service |
| B. Car Dumper  | F. Utility Man          |
| C. Car Trimmer | G. Laborer-Unskilled    |
| D. Sampler     |                         |

TABLE 3

# PREPARATION PLANTS AND OTHER SURFACE FACILITIES FOR DEEP OR SURFACE MINES

**GRADE 4**

DAILY WAGE RATE: 12/6/76 \$53.02/day

## CLASSIFICATIONS:

- A. Electrician
- B. Machinist
- C. Mechanic

- D. Welder, First
- E. Preparation Plant Central Control Operator

**GRADE 3**

DAILY WAGE RATE: 12/6/76 \$51.25/day

## CLASSIFICATIONS:

- A. Mobile Equipment Operator
- B. Repairman
- C. Stationary Equipment Operator
- D. Welder

- E. Railroad Car Loader Operator
- F. Maintenance Trainee
- G. (max. 12 mos.)
- G. Electrician Trainee
- (max. 12 mos.)

**GRADE 2**

DAILY WAGE RATE: 12/6/76 \$49.20/day

## CLASSIFICATIONS:

- A. Tipple Attendant
- B. Dock Man
- C. Electrician Helper
- D. Machinist Helper

- E. Mechanic Helper
- F. Repairman Helper
- G. Maintenance Trainee
- (max. 6 mos.)
- H. Electrician Trainee
- (max. 6 mos.)

**GRADE 1**

DAILY WAGE RATE: 12/6/76 \$48.62/day

## CLASSIFICATIONS:

- A. Car Dropper
- B. Car Dumper
- C. Car Trimmer
- D. Sampler
- E. Bit Sharpener

- F. Truck Driver, Service
- G. Equipment Operator, Service
- H. Preparation Plant, Utility Man
- I. Surface Utility Man
- J. Laborer-Unskilled

## CHAPTER FOUR TRAINING INTERESTS

The four groups considered in this report were questioned as to their training needs, and also as to what type of training they felt would be appropriate for community college involvement. The type of training programs suggested tended to depend on the individual institution's location relative to mining companies, and on the ability of the community college to commit space for a mining shop.

It is important to note the physical requirement for conducting a class that entails the repair of actual mining equipment. Although equipment characteristics vary, a continuous miner can be expected to be about thirty four feet long, eleven feet wide, and from twenty four to sixty inches high. These machines commonly weigh from 50,000 to 100,000 pounds. Other types of mining equipment are proportionally large.

If the educational institution can institute co-op programs with local coal companies, students can obtain experience with actual mine equipment, without the institution's housing or purchasing it. A continuous miner may cost from two hundred fifty to three hundred thousand dollars.

The curriculum proposed in Chapter Seven entails the use of training panels for electrical and hydraulic laboratory work. These panels may be purchased from mining equipment manufacturers listed in Chapter Eight. Prices range from approximately \$700 for a basic electrical panel to \$15,000 for a continuous miner training panel.

If the educational institution is contemplating a mine maintenance mechanic program, a listing of suggested tools and equipment and recommended shop layout may be found in Mine Maintenance, published by the West Virginia State Board of Education. (see Instructional Material Sources, Chapter Eight)

For convenience, the discussion of training interests is divided into general subject/job classification groups rather than interest groups.

### SAFETY

Miners, operators, suppliers, regulatory agencies, and labor are all concerned with the safe production of coal. Any accident is of personal interest to the individual injured, his co-workers and their union. Accidents cause increased government scrutiny and lost production time. From many perspectives safety is the most universal concern in the deep mining industry. Any mining curriculum which purports to meet the needs of the industry, either at the entry level or as an upgrading program, should train or retain in safety for the specific job being taught; and, in safety procedures in general.

An area of common interest and concern to all groups is the advent or the refinement of Emergency Medical Training. The Pennsylvania Department of Deep Mine Safety, for example, has initiated, and is interested in, continually upgrading the Emergency Medical Training capabilities at every mine site.

All miners should be trained in effective Cardiopulmonary Resuscitation (CPR) and given the opportunity to complete Emergency Medical Technician I Training. Mine foremen and/or mine superintendents should strive to become qualified to teach EMT I.

All programs for miners should place strong emphasis on accident prevention as well as on mine emergency procedures; mine rescue, first aid, fire control, as well as accident prevention. Supervisory training must include courses which will enable the student to become an effective teacher. Indeed a supervisor, as such, will be expected to instruct personnel in safety and company procedures.

### MAINTENANCE

Maintenance tends to be of universal concern to all segments of mining. Mine operators are concerned with cost-effective preventive maintenance, and equipment repair. Government regulatory agencies, both state and federal, are concerned with maintenance in that there are laws governing who can perform repairs and how repairs are to be made. Since most underground coal mining equipment is electrical, the electrician and the electrical training he receives is scrutinized and/or regulated by both state and federal governments. Ideally maintenance training would include electrical, hydraulic, and mechanical courses.

As previously stated, mining equipment is powered electrically, either by rechargeable batteries or through trailing cables connecting the mining machine to underground power distribution network. The mine electrician is responsible for overseeing the safe trouble shooting and repair of equipment and power cables. Certain mining equipment is required to be permissible.

Permissible equipment, simply defined, is equipment that meets federal requirements for explosion containment. Since the motors of electrical mining equipment are often controlled by sparking relays, these relays must be enclosed in permissible enclosures. If an explosive concentration of methane is present, and a spark ignites the gas/air mixture, the permissible container must release the force of the explosion while containing the flame.

This explanation of permissibility is presented only to illustrate the importance of competent electrical training. The mine electrician may work with voltages of one thousand volts in what could be termed the worst environment for high power.

The course content for electrical maintenance training should include all of the material contained in the outline for the federal electrical qualification course.

Students should also become familiar with state electrical requirements, as they are sometimes more stringent than federal regulations.

Electrical instruction should provide a working knowledge of electrical theory its application to the mine environment, and the electrical components used. Students should be trained in diagnostic and repair procedures using training panels or actual equipment.

Since hydraulic systems are found on most mining machines, students should be given a working understanding of the physics of hydraulics and have a thorough knowledge of hydraulic components and systems. As with electrical training, diagnostic procedures should be taught and practiced either on actual equipment or on training panels purchased from mining equipment manufacturers (Illustration 8)

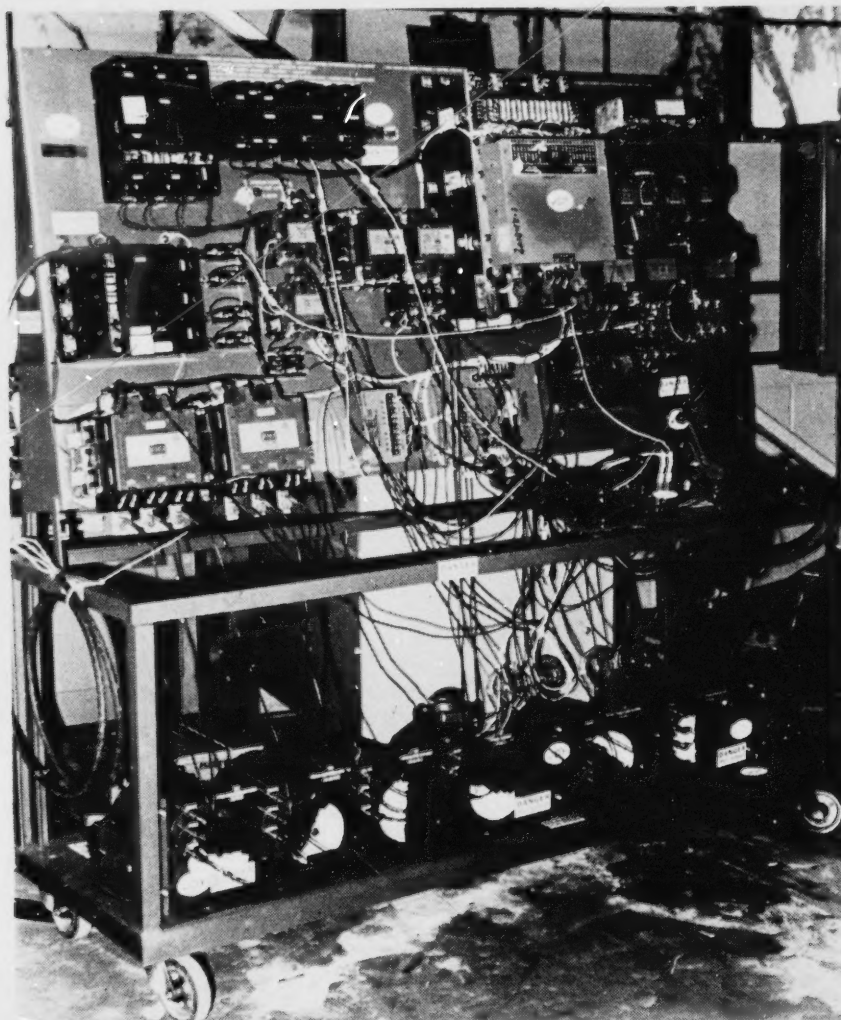
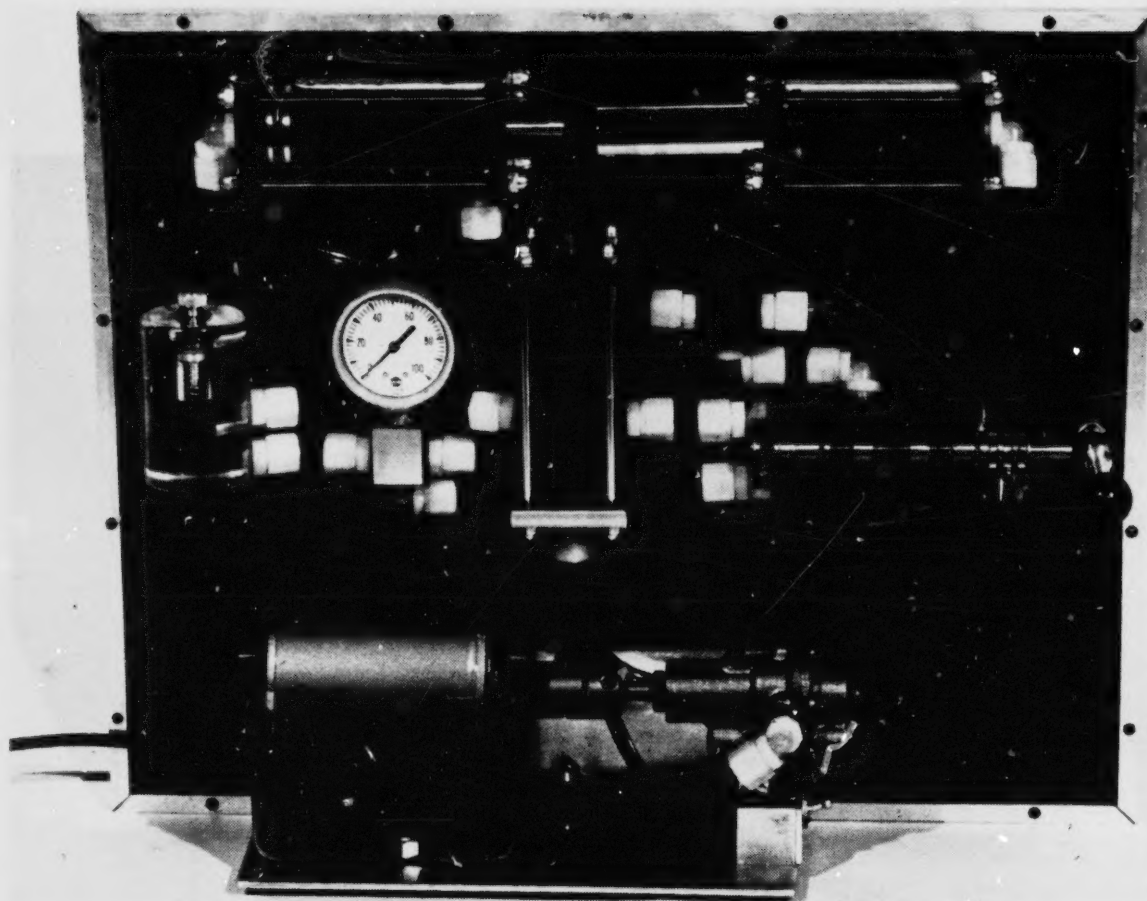


ILLUSTRATION 8 Electrical Training Panel - Joy Manufacturing



Basic Hydraulics Training Panel - Jeffrey Dresser Industries

Mechanical training would cover the structural maintenance of machinery. This would include welding, fabrication, and a working knowledge of material properties. As the discussion of permissibility points out, making the machine operate is often not enough. Repairs, electrical as well as mechanical, must maintain the mining equipment in safe, permissible and productive condition. Maintenance training would also cover mechanical power transmission. Gear trains, speed reducers, and braking systems would be some of the systems covered.

## SUPERVISORY

Mining operators are extremely concerned with developing supervisors from those who are currently employed as miners or individuals who are applying to their companies.

As was previously mentioned the section foreman is the first level supervisor. As such, he is responsible for the safety and the production of men working his section. Maintenance workers on the section report to the section foreman and also to the maintenance foreman/chief electrician.

Both the mine foreman and the section foreman must be certified according to state law. The primary difference in requirements is the number of years of experience required. Educational programs should be geared toward the requirements of the mine foreman, since the students will likely follow this progression; miner trainee, miner, machine operator, fireboss, section foreman, and mine foreman.

A curriculum to qualify a student as a mine foreman would include instruction in supervisory skills, maintenance, gas detection/ventilation, roof and rib, dust and noise control, production planning, and state and federal law.

Because the foreman is the "man in charge," he must be an effective supervisor. Since in most mines the miners are represented by the United Mine Workers Union of America (UMWA), the supervisor should be familiar with the mandates of the contract so he can avoid a "wild-cat" strike situation. An educational institution should present typical key contract provisions and how they define the rights and responsibilities of both parties, however, the educator should not venture to interpret contracts. A union representative should be brought in to discuss specific points and interpretations. The reader is cautioned that instructor error in contract matters, especially if his class has students who are currently employed as miners, can create substantial problems within the mining industry.

The supervisor should be knowledgeable about maintenance procedures and basic electrical, hydraulic and mechanical systems. The more knowledge he has of the equipment used in the mine along with its capabilities, limitations, and proper care, the more productive and safe his shift will be.

Because gas detection and ventilation and roof and rib control are a large part of the mine foreman's concern, he must be trained (qualified) in the detection of harmful gases found in coal mines; the most common of these being methane. Students should be taught the care and use of the various approved gas detection apparatus. They should also be trained in the operation of anemometer (wind speed measuring device) and proficient in the calculation of air flow. Supervisory personnel must be able to detect deficiencies in the atmosphere at the working place and make corrections in air flow to effect a safe and legal environment.

The supervisor must learn safe, effective methods of supporting the roof and controlling the rib of the mine. Although roof control plans are submitted to the federal government for approval, the foreman must be certain the plan is followed and that additional support is provided where needed. He must also be aware of the current standards for dust and noise control. He should understand the hazards of exposure to these products of modern mining and determine ways to minimize danger to the miners.

Production planning education entails a knowledge of cost effective maintenance, coal preparation plant operations, and efficient production procedures. Stories are related in the mining industry about the face boss who, in the interests of high production on his shift, would not permit the maintenance man on his section to have a continuous miner shut down for twenty minutes to replace a grease plug which had fallen out. By the end of the shift all of the lubrication from a gear case had escaped and the gear system failed. Repairs kept the miner out of service for three shifts and cost the company approximately \$20,000. This story may not relate an actual event, however, it is entirely plausible.

Miners and Supervisors must be aware of the State and Federal laws which govern their working procedures and dictate the minimum standards of their working environment. Because there is so much legislation governing mining, the supervisor must be familiar with the various rules and regulations and must be able to adapt to legislative changes.

## ENTRY LEVEL

Another level of training which is appropriate for community college involvement is Entry Level Training. Most mining operators contacted feel that an applicant for employment who has attended some type of training has made a commitment to the mining industry. If a potential miner receives a basic orientation to mining and its inherent hazards he is less likely to be injured when he begins his employment.

A four-day pre-employment training is required by the current UMWA contract. The first three days are classroom orientation to the mining industry; the fourth is a tour of the mine the trainee is going to work in.

Entry level training can be as short as the contractually required training or as long as six weeks. Recommended in Chapter Seven is an eighty hour training program which entails a minimum of equipment. An example of a longer and much more expensive training program is one conducted by the Adult Education Division of Belmont County, Ohio Joint Vocational School. The five-week program utilizes a simulated mine with actual equipment. Students are given extensive classroom training and taught to operate some basic types of mining equipment.

Though the student will not be able to operate this equipment for ninety days (UMWA contract) up to one year (or whatever minimum is established by the state), he is much more employable than an applicant with no knowledge about mining.

The major emphasis of an entry level training program should be on safety. Hazards of the mining environment and mining equipment should be thoroughly covered, as should first aid (including CPR) and mine emergency procedures.

## CHAPTER FIVE CONCLUSION OF ASSESSED NEEDS

Since the mining industry is controlled by federal regulations as outlined in the Code of Federal Regulations Part 30, in each state by its own Mining Laws, and by the UMWA contract, it is important that individuals be accurately instructed in certain procedures. Education must not necessarily delineate, however, it must make a miner aware that in a specific job there are perhaps two or three legally binding documents that tell him how to do this job, when he can do it, how he cannot do it, what qualifications or certifications he must have before he does it, etc. In any course of instruction the law and safety regulations tend to be the guiding factor in the course work.

It is evident from the considerations outlined above that any mining program be it entry, upgrading or pre-supervisory education must involve safety training; safety not only includes first-aid and emergency medical training, it entails gas detection, roof and rib control, hazards in haulage, and electrical knowledge.

Because maintenance is such a large consideration in mining, almost all programs from the entry level training through the supervisory level training must concern themselves with maintenance and operation of equipment. At this point, it is prudent to make a distinction between supervisory courses designed to enable the individual to pass state certification tests and supervisory programs designed to give the person the skill to be a supervisor. Most frequently, an individual either with experience or perhaps with an Associate Degree will, immediately prior to taking a foreman test, receive some sort of crash training course. In this kind of a program, obviously, maintenance training or training per se is not done. In a broader program, that is the two-year Associate Degree program or perhaps even a one-year supervisory skill training program, maintenance is not only a concern to the maintenance foreman or the maintenance individual, but also to the section foreman, since the maintenance men on his section fall under his supervision. They also report to the mine superintendent, and/or the chief electrician, depending on the labor structure of the mine.

In general, the mining operators feel that there is not particularly a shortage of individuals applying for work in a mine due to the labor structure and high wages in mining. However, there seems to be a shortage at all levels of trained individuals either applying for work or bidding on higher classification jobs. There is a need, therefore, for educational institutions to consider mining education at whatever level is appropriate to their facilities, and also in whatever way seems most appropriate to mining operators in the immediate area. Decision-making considerations are presented in Chapter Eight. On the basis of information found in Determination of Labor Management Requirements in the Bituminous Coal Industry to Meet the Goals of Project Independence, a paper published August 27, 1975, by the Federal Energy Administration, the manpower requirements of the industry are illustrated by projections found in Table 4. These projections were compiled by the Federal Energy Administration on the basis of: increasing coal production at

the expected rate, new mines that may or will be opening, and the current bimodal age distribution of labor, hence the retiring of individuals from the industry. Projections are given for the entire mining industry. Of the total requirement of 144,100 workers over the eleven year period, 60% will be for expansion of facilities and new mining operations; about 40% will be for individuals to replace those currently employed.

### Projected Manpower Requirements for Growth and Replacements in the Bituminous Coal and Lignite Mining Industry 1975 - 1985

| YEAR         | GROWTH        | REPLACEMENTS  | TOTAL          |
|--------------|---------------|---------------|----------------|
| 1975         | 17,300        | 6,250         | 23,550         |
| 1976         | 11,200        | 6,000         | 17,200         |
| 1977         | 7,300         | 6,000         | 13,300         |
| 1978         | 7,000         | 5,750         | 12,750         |
| 1979         | 6,100         | 5,400         | 11,500         |
| 1980         | 6,200         | 5,100         | 11,300         |
| 1981         | 7,300         | 4,800         | 12,100         |
| 1982         | 7,100         | 4,600         | 11,700         |
| 1983         | 6,500         | 4,400         | 10,900         |
| 1984         | 6,600         | 4,200         | 10,800         |
| 1985         | 5,000         | 4,000         | 9,000          |
| <b>TOTAL</b> | <b>87,600</b> | <b>56,500</b> | <b>144,100</b> |

**Table 4 from Determination of Labor Management Requirements in the Bituminous Coal Industry to Meet the Goals of Project Independence, August, 1975, Federal Energy Administration.**

The projected increase in coal production required if the U.S. is to institute a national energy policy would be realized by employing individuals who are new to the mining industry. This would be necessary due to the attrition and retirement of workers. It is universally accepted that the more individuals who enter the mining industry, having had previous training, be it limited or extensive, the safer mining operations will be. As a result, mining operations will be more productive.

In conclusion there are several factors which direct educational institutions to involve themselves in mining technology programs:

- Increased emphasis on coal or fossil fuel as an energy source due to the uncertainty of reliance on nuclear energy and due to the five hundred year coal reserves as opposed to the relatively short reserves of gas and oil.
- Turn-over or the increase in manpower that will be necessitated by production increased, not only because of expanded operations but also because of the current labor force composition to replace miners who are now eligible for retirement and who will retire in the very near future.
- The increase in coal production required for energy independence. The more training received by individuals employed by mining, the more productive the individual is likely to be in his employment career. If the coal companies have a field of individuals to select from for employment, they invariably will choose individuals with the most relevant training.

Mandatory training and pre-employment training. Currently, the state mandates experiential requirements that can often be reduced by education in state certified positions. Since there are currently provisions within the system for this education, not only to benefit the individual knowledge level but also to benefit him in his work experience, education should be readily available to fill these requirements.

Pre-employment training enables an individual to make the best possible use of his pre-certification work limitations. Pre-employment legislation is currently being revised at the State and Federal level. This legislation will probably require that all individuals, prior to employment, participate in a training program such as West Virginia's eighty-hour program. It seems that with the expansion of the coal industry within the next ten years and with the increase in legislated training requirements, some community colleges and two-year proprietary schools must involve themselves with the mining industry now, before, and during the process of legislated training. Programs such as West Virginia's eighty-hour program have been developed through extensive research done by expert external concerns. They should be utilized by states that may currently not have mandatory pre-employment training by state law.

Educational institutions that do not have extensive mining in their area but who have some surface or deep mining should strongly consider implementing a heavy equipment maintenance program. This program would include the theoretical studying of electrical application, diesel mechanics, structural fabrication, and hydraulic repairs. The course could be expanded by the use of electrical and hydraulic training panels available through the mining industry and other materials available through surface equipment manufacturers. This program could include elective courses in mining. The graduate of a program such as this would be attractive to a mining company in that he would be well-qualified to perform maintenance on mining machinery. He would not be as qualified as an individual who had gone through a mine maintenance mechanics training program, however, if the theory instruction and the practical lab work were well done, the individual would have a substantial background applicable to mining. Individuals graduating from such a course could find work in equipment maintenance of many and varied types; not only those equipment pieces used in surface mining, but similar equipment used in construction work.

If an educational institution is in the vicinity of interested mines, the best balance of education would be obtained by co-operative programs, whether it be a pre-employment orientation program or a two-year Associate Degree program. Co-op programs would involve the individual's going to school full-time for a year and then going to school part-time and working, or, perhaps, alternating every three weeks or six weeks working and going to school. This procedure, especially in the instance of a foreman or a foreman trainee, would enable the individual to obtain classroom instruction simultaneous to his accruing experience required by state law. The individual could schedule to complete his foreman

training in an Associate Degree program, for example, simultaneous to his completion of the experiential requirement in his state.

Local coal companies are best able to help the community college determine what type of training it should undertake. The best way of determining the critical needs of coal companies is to set up an advisory committee.

## CHAPTER SIX ADVISORY COUNCIL

Because the training needs of the coal mining industry vary from mine to mine, it is important to obtain local support for a mining program. The most efficient way of providing relevant education is the formation of an advisory council. Various interests of the coal industry should be invited to participate in the establishment of the council.

### COMPANIES

Coal company representatives would make up the majority of the advisory council membership. A representative from each coal company with a mine (surface and deep) located within the educational institution's catchment area, should be appointed to the advisory committee. If the mining company has a training department, as larger companies often do, the director is normally the appropriate contact person. If the company does not maintain a training director, the personnel manager should be contacted.

Locating the mining companies is an easy task if the appropriate references are consulted. One of the most comprehensive listings of coal operators, broken down by state, county, and individual mine, is the current issue of the Keystone Coal Manual which gives listings of top management personnel along with production information.

The other groups to be represented on the advisory council are not listed in order of importance. An organizer of a mining technology council should be aware that the inclusion of all the listed groups may create a body interested in discussion of industry-related problems beyond the scope of education and training.

### MINING EQUIPMENT MANUFACTURERS

Four large mining equipment companies are Joy Manufacturing, Jeffrey Dresser, National Mine Service, and Lee Morse. Local concerns who repair mining equipment should also be contacted. These companies can also be located by consulting the Keystone Coal Manual. Many mining equipment manufacturers maintain in various respects a customer/relations customer/training department whose representatives can provide invaluable program assistance. Many equipment manufacturers sell training panels (Figure Nine) which allow an instructor to teach electrical and hydraulics aspects of equipment operation in a classroom-laboratory setting. As mentioned in Chapter Four, equipment manufacturers are very committed to general mining education.

### LABOR

Labor unions participation in an advisory committee is also desirable. Job bidding procedures and provisions for co-op training need to be worked into existing work rules and contract terms. In most cases, the UMWA is the union representing labor. They maintain a local office in most mining communities. If contact is initiated at the District level, the District's president and/or the Safety Committee man would be most likely to provide input to the educational program proposed. The names and addresses of these individuals can normally be obtained from the local UMWA office; however, if difficulty is experienced, the UMWA's Research Department, 900 Fifteenth Street N.W., Washington, D.C. 20005, can provide the necessary contact information.

## REGULATORY AGENCIES

State: For example, in Pennsylvania the Pennsylvania Department of Deep Mine Safety is the state agency dealing with underground mining. The Director should be contacted to recommend a representative for an Advisory Council. Often this will be a state mine inspector. Because the educational requirements for state certification (as stated in Chapter Three) may be one objective of a mining technology program, the state's input can assist in the development of a program to fulfill that objective.

Federal: The Mine Enforcement and Safety Administration, MESA is the federal agency which deals with training and enforcement. The Regional Office of the Director of Training, MESA can recommend a representative. The address of the local Training Center can be obtained by contacting the Office of the Administrator, Mining Enforcement and Safety Administration, Department of the Interior, Room 618 Ballston Tower #3, 4015 Wilson Boulevard, Arlington, Virginia, 22203. The Training Department can provide invaluable instructional materials for areas in which the Code of Federal Regulations requires training and retraining.

## CHAPTER SEVEN PROPOSED CURRICULA

### INTRODUCTION

Following are several curricula to be considered by an advisory council formulating a Mining Technology program. Several types of program scheduling might be considered for all but the entry level training. If the student population is to be drawn from high school graduates not employed in mining, courses may be offered on the institution's regular day/evening schedule. If a co-op program can be arranged modification of this schedule may be necessary. If the Mining Technology program is to be attended by current employees, on their time, classes will have to be scheduled so that when individuals change shifts they can change the time they attended class. This will usually necessitate offering morning and night classes covering the same material at the same rate. Continuity in learning would be preserved by utilizing the same instructor.

Concurrent with the review of proposed curriculums, educators must concern themselves with Mining Technology instructors.

If the program is addressed to currently employed miners, the mining instructors should have working experience as section foremen, mine foremen, or maintenance foremen. In pre-employment programs and in other programs addressed to current non-miners, instructors should be experienced miners.

Educational and experience background requirements must, of course, be flexible. Here are some suggested sources for mining instructors; sources received from mining companies:

- Retired mine foremen, mine superintendents, section foremen
- Recent mining engineering graduates
- Disabled miners
- Secondary teachers with mining experience

The above represent possibilities for instructors, but none necessarily represent the ideal. Here for instance, are some problems that might arise:

- Retired and disabled miners might not have current knowledge of new machinery techniques and new laws.
- Recent mining engineering graduates may not have mining experience.

If the aforementioned people have the necessary level of experience and are current in their knowledge of the industry they may not necessarily be good teachers.

Many vocational programs at the two-year level suffer from the difficulty of locating suitable instructors. However, the largest obstacle in the hiring of mining technology instructors is the salary schedule of the educational institution.

Individuals who have mining experience and who possess the ability to be good teachers usually also possess supervisory skills sufficient for them to be section foremen, mine foremen, mine electrician or maintenance foremen. The educational institution, of course, puts itself in competition with the mining industry in the recruitment of these individuals. With miners earning from \$11,000 to \$17,000 per year, and supervisory personnel from \$15,000 to \$30,000 per year, the attraction to remain within the production management segment of the coal mining industry instead of teaching would be great.

Educational institutions contemplating a mining program would do well to consider hiring part-time instructors from within the mining industry and from state and federal mining agencies. A mining program should draw heavily on guest lecturers; state and federal mine inspectors, UMWA safety committee men and training managers from coal companies, to cite only a few examples. Educators can moreover make valuable industry contacts through involvement in a Mine Educators Association. Company training managers will be able to provide information as to the meeting times and locations. If, of course, such an association does not exist in your catchment area, an excellent way to become involved in mining might be to start one.

Schools initiating mining technology courses will find it beneficial to have instructors in non-mining technical courses thoroughly acquaint themselves with mining procedures and the mining environment. The class content of non-technical courses would benefit the mining student if the instructor has an understanding of mining. It has been frequently stressed that a "Principles of Management" course; for example, can be very valuable if taught by an individual who has had exposure to mining. Schools might find it advantageous to have certain non-mining instructors receive underground experience.

Following are mining technology curricula suggested for review.

### PRODUCTION SUPERVISION

Designed to enable the individual to become Assistant Mine Foreman after having accrued the working experience required by State Law.

| First Semester   | Credits | Second Semester            | Credits |
|------------------|---------|----------------------------|---------|
| Intro to Mining  | 3       | Mine Environment Control I | 4       |
| Geology of Coal  | 3       | Drafting                   | 3       |
| Communications   | 3       | Human Relations            | 3       |
| Technical Math I | 3       | Technical Math II          | 3       |
| Hydraulics I     | 3       | Principles of Electricity  | 3       |

| Frist Semester              | Credits | Second Semester                               | Credits |
|-----------------------------|---------|-----------------------------------------------|---------|
| Mine Environment Control II | 4       | Coal Preparation/Analysis                     | 3       |
| Surveying/Mine Mapping      | 3       | Electrical Power Distribution and Application | 3       |
| Technical Report Writing    | 3       | Welding I                                     | 3       |
| Intro to Data Processing    | 1       | Labor Management, Labor Contract              | 3       |
| Effective Supervision       | 3       | Mine Emergency (Fire, First Aid, Rescue)      | 3       |

## MINE MAINTENANCE

Designed to prepare students for maintenance jobs in mines, leading to maintenance supervisory positions after obtaining working experience.

| First Semester              | Credits | Second Semester               | Credits |
|-----------------------------|---------|-------------------------------|---------|
| Intro to Mining             | 3       | Mine Environment Control I    | 3       |
| Geology of Coal             | 3       | Drafting                      | 3       |
| Communications              | 3       | Human Relations               | 3       |
| Technical Math I            | 3       | Technical Math II             | 3       |
| Hydraulics I                | 3       | Principles of Electricity     | 3       |
| Third Semester              | Credits | Fourth Semester               | Credits |
| Mine Environment Control II | 3       | Effective Supervision         | 3       |
| Technical Report Writing    | 3       | Electricity                   | 3       |
| Mechanics I                 | 3       | Electrical Power Distribution | 3       |
| Welding I                   | 3       | Welding II                    | 3       |
| Hydraulics II               | 3       | Mine Emergency                | 3       |

## HEAVY EQUIPMENT MAINTENANCE

| First Semester           | Credits | Second Semester                               | Credits |
|--------------------------|---------|-----------------------------------------------|---------|
| Elective                 | 3       | Drafting                                      | 3       |
| Earth Science or Geology | 3       | Human Relations                               | 3       |
| Communications           | 3       | Technical Math II                             | 3       |
| Technical Math I         | 3       | Principles of Electricity                     | 3       |
| Hydraulics I             | 3       | Internal Combustion Mechanics                 | 3       |
| Third Semester           | Credits | Fourth Semester                               | Credits |
| Welding I                | 3       | Welding II                                    | 3       |
| Technical Report Writing | 3       | Safety in Equipment Repair                    | 3       |
| Mechanics I              | 3       | Effective Supervision                         | 3       |
| Metallurgy               | 3       | Electrical Power Distribution and Application | 3       |
| Preventive Maintenance   | 3       | Systems Diagnosis                             | 3       |

## PRE-EMPLOYMENT TRAINING

Because of the need to promote safety in mining, coal companies, labor unions, and government agencies agree that pre-employment training is desirable.

A complete course has been developed by McDonnell Douglas Corporation for the West Virginia Department of Mines. Extensive research was conducted in the development of the objectives for this program, and it provides an excellent basis for pre-employment training. Minor changes of the course content will be necessary when the training is being used in a state other than West Virginia, as state mining laws and regulations differ. The appropriate changes can be easily made by an instructor familiar with his state laws.

## WEST VIRGINIA UNDERGROUND MINING HEALTH AND SAFETY PROGRAM

### COURSE CONTENT - 80 HOURS

1. General Orientation to Mining
2. General Safety (2 units)
3. General Mining Safety (2 units)
4. Ventilation
5. Roof and Rib Control
6. Recognition and Avoidance of Electrical Hazards
7. Haulage Safety
8. Mine Gases and their Detection
9. Prevention and Control of Mine Fires and Explosions
10. First Aid (6 units)
11. Health and Sanitation
12. State and Federal Laws and Regulations
13. Miner and Operator Rights and Responsibilities
14. Underground Tour

Materials available for the 80 hour program include student guide, a complete instructor guide, slides and transparencies. Information regarding these materials can be obtained from:

Vocational Curriculum Laboratory  
Cedar Lakes Conference Center  
Ripley, West Virginia 25271

## MINING TECHNOLOGY COURSE DESCRIPTIONS

### Introduction to Mining 3:0:3

Introduction to Mining covers current mining methods and machinery, both surface and underground, and the history of their development. History of government agencies dealing with the mining industry. Includes field trips to both surface and deep mines.

### Geology of Coal 3:0:3

Basic geology with emphasis on coal deposits and adjacent strata characteristics. Includes basic chemistry applicable to mining.

### Mine Environment Control I 2:3:4

Covers basic information on deep mine conditions, measurements and modifications. Included is roof and rib control, ventilation, methods and measurements, gas detection, equipment operation and maintenance, dust and noise control, haulage, safety measurements, and general working environment hazards. Covers applicable state and federal laws.

### Mine Environment Control II 2:3:4

An extension of Mine Environment Control I. Entails MESA qualification instruction and testing, when appropriate in listed areas.

### Surveying - Mine Mapping 2:3:3

Measuring, use of transit, level, and other surveying instruments. Surveying as used in mines: instructions in surface and underground traversing.

### Coal Preparation and Analysis 3:1:3

Covers methods used in cleaning, crushing and sizing coal. Students will become familiar with apparatus and general maintenance procedures in preparation plant. Provides student with exposure and experience in coal analysis techniques. Field trips to preparation plants and coal using industries.

### Labor Management - Labor Unions 3:0:3

An introduction to management, relations of management theory and the viewpoints of the behavioral sciences to problems, policy and practice in managing people. Labor relations and contract grievance procedures as they relate to mining. Course will make extensive use of guest lectures from the UMWA (and other miners unions if locally represented) and from management.

### Mine Emergency 2:2:3

Includes mine rescue, accident prevention and first aid. Red Cross CPR training will be included. Mine fires and ignitions will be covered as will accident reporting procedures.

### Mining Electricity 2:2:3

In depth study of AC and DC control circuits and devices. Trouble shooting and repair will be performed on electrical training panels, actual equipment will be examined and trouble shooting techniques applied.

## OTHER TECHNOLOGY COURSES

### Hydraulics I 3:0:3

A study of basic hydraulic theory and various applications. Emphasis will be on a fundamental understanding of components, their limitations and use. Classroom demonstrations will utilize panels and components.

### Hydraulics II 2:2:3

Advanced study of material in hydraulics I. Student will become familiar with test instruments and their use.

### Principles of Electricity I 2:2:3

Basic study of AC and DC circuits, components and schematics. Emphasis on motors and methods of speed control.

### Electrical Power Distribution 3:0:3

Electrical power distribution will be studied from power-generation facilities to working place. Emphasis will be on the safe and efficient methods of powering electrical equipment.

### Welding I 2:4:3

Basic oxyacetylene and arc welding. Safe and correct methods of assembly and operation of welding equipment. Practice in flame cutting, gas and arc welding in flat, horizontal and vertical positions. Emphasis on safety.

### Welding II 2:4:3

Practice on vertical and overhead welding. Introduction of tungsten-arc-inert gas welding (T.I.G.) procedures on aluminum, stainless steel and steel. Also covers resistance welding.

### Metallurgy 1:4:3

A study of the manufacturing of metals and alloys emphasizing their properties as to weldability. Covers testing procedures, and includes practical problems encountered in fabrication.

### Mechanics 3:0:3

Study of principles and analysis of stresses which occur in structural elements subjected to static loads. Methods of calculation of relations, stresses, resultants, shear and moment diagrams and their application in various structural problems. Includes study of force systems.

### Internal Combustion Mechanics 2:3:3

Exposes the student to the various types of gasoline and diesel engines. Emphasis is placed on diesel engine efficient operation and repair.

### Drafting 1:3:3

Beginning drafting course objectives are: understanding of parallel projection, skill in orthographic, axiometric and oblique in detailing assemblywork drawings. Interpretation of industrial sketches and shop prints are introduced to emphasize accepted drawing practices.

### Preventive Maintenance 2:2:3

Course emphasizes the efficient use of preventive maintenance and the preparation of maintenance schedules based on empirical data. Sample industrial equipment will be studied to determine cost effective maintenance procedures.

- Systems Diagnosis** 0:5:4  
Practical class involved in detection problems in "bugged" equipment. Electrical, hydraulic and mechanical systems will be bugged by instructor, individually or in combination. Student work crews will diagnose and write repair orders to correct problem.
- Safety in Equipment Repair** 1:2:3  
Covers OSHA regulations pertaining to heavy equipment repair. Safe methods of using tools and testing of repairs made.
- Geology** 3:2:3  
Study of the earth's processes and the resultant changes in its crust. Study of rocks, minerals, topographical maps.
- Technical Math I** 3:0:3  
This course stresses the practical approach to mathematics. It includes a review of fundamental algebraic operations and solution of linear equations. An introduction to slide rule, systems of linear equations, determinants and right triangle trigonometry.
- Technical Math II** 3:0:3  
A thorough treatment of simultaneous equations, logarithms, exponents, and radicals, and quadratic equations. An analysis of algebraic logarithmic, exponential, and trigonometric functions.
- Introduction to Data Processing** 3:0:3  
Data processing for non-data processing majors. Unit record equipment and applications, computer processing and stored program concepts, central processor, input-output components, flow charting, documentation, and programming.
- Communications** 3:0:3  
Written and oral communication skills needed in business and industry constitute the individualized goals for this course. Emphasis is on vocabulary, spelling, writing memos, and simple business correspondence, completing forms, etc.
- Technical Report Writing** 3:0:3  
Techniques of report writing is designed to teach fundamentals of writing various kinds of reports.
- Human Relations** 3:0:3  
This course is designed as an introduction to the basic principles of sociology, general psychology, and industrial psychology. Major emphasis is placed on such topics as the origin and development of the social body, group behavior, and the problems attendant to leadership and cooperation. Designed to develop a thorough understanding of human relationships in the industrial and business complex.
- Effective Supervision** 3:0:3  
Designed to teach the student to apply supervisory techniques to practical situations. Extensive use of simulated labor/management encounters are utilized. The student will also learn instructional techniques.

## CHAPTER EIGHT CONCLUSIONS

From the onset this publication has stated that many elements of the decision-making process related to the predictions of future manpower needs in the mining industry, and the nation's dependence on utilization of coal will not be included in the discussion but remain as major factors in the decision regarding the development of educational services for the mining industry. Those who are sincerely interested in developing educational programming must carefully examine the current literature and reputable agency predictions concerning the future of the mining industry prior to initiating the educational institution's investment in the non-degree and/or degree program. This point of discussion aside, the following list of planning considerations serve as guidelines toward effective decision making:

### 1. Contact with area MESA office

- Number of mines in institution's catchment area.
- Projected life of mines in area.
- Number of miners employed in area (Industrial Directories).
- Number of residents employed in mining in institution's catchment area (Industrial Directories).
- Number of projected new mines.

### 2. Contact with Area Mining Owner/Operators - Employers

- Are new mines projected?
- Number of new-inexperienced miners hired in past six months.
- Do you conduct any training for new miners/experienced miners?
- What type of training? Maintenance, Supervisory, Pre-employment
- Are you aware of other institution's offering mining training or mining technology courses within area?
- Their satisfaction with existing training.
- Their interest in jointly pursuing alternative training development or adjusted training development.
- Scheduling requirements due to shift work, certification requirements, pre-employment, skills upgrading, etc.

Obviously, contact with the owner/operators will quickly lead to their perception of your contact with them to discuss training. Regardless of their perception, you must receive their rationale for the range of attitude from extremely negative ("The more my worker's think, the more trouble I will have."), to highly supportive ("I am in need of a whole gamut of training.") It must be remembered that the mining industry, like most industries, is composed of supplies, labor, labor organizations, management, corporate firms, small independent owners, government agencies, supporting firms assisting with safety programs, etc. Your basic questions with the owner operators-employers will be moderately revised but regularly repeated among the representative groups comprising the mining industry.

### 3. Additional contact with Mining Industry Representative Groups

- Repetition with minor modification, of questions in section two.
- Assessment of attitudes regarding a variety of training formats:
  - Full credit programs.
  - Special orientation program.
  - Continuing education with C.E.U. serving as incentive for further education.
  - Special seminars and workshops; i.e., Safety, Management, etc.
  - Maintenance program.
- Training Locations
  - Space requirements
  - Equipment investment.
  - Cooperative faculty exchange of location, on the job work release for training, evening programs at educational institutions.
  - Independent study with supporting group presentations.
- Organization's ability to support training costs, assist in the recruitment of faculty, and generate or locate materials.
- Their willingness to appoint a representative to a Planning and Advisory Council.
- Their unofficial projection of training needs.

These initial questions are quite basic and should give clear indication of the area mining industry's desire and documented need for present and near future training assistance. At this state the "decision maker" must begin to consider the educational institution's capability and general personnel support for the development and implementation of a mining technology educational programming service. The basic considerations are money to sustain and develop the program and the length of time the program will be offered before the area is educationally "saturated" with mining training.

### 4. Discussions within the institution

- Availability of initial and developmental funds through the following potential resources:
  - State Vocational Education Funds
  - Comprehensive Employment and Training Act
  - Paid tuition via labor organization, fringe benefit packages provided by employer
  - Free materials from mining industrial supplies, government agencies
  - Employer sponsored instructors salary, space rental, equipment use/donation, consummables, etc.
  - Energy Research and Development Act
  - Cooperative Education
  - Government Personnel Administration Training Funds through area Economic Development Agencies and Intergovernmental Personnel Administration Agencies
- Availability of mining site for utilization of major equipment and available space thus reducing equipment investment by educational institution.
- Faculty's ability to adequately instruct program content.

- c. Faculty's ability to adequately instruct program content.
  - 1. Standards for additional instructor recruitment.
  - 2. Scheduling requirements in comparison to college's usual scheduling pattern and faculty collective bargaining regulations.
  - 3. Overlapping of presently designed curricula with mining training requirements.

Following these considerations, the "decision makers" should foster a development, implementation, and maintenance strategy if the previous information is highly supportive of a training program. In preparation of that strategy, the following additional assistance is provided by the Westmoreland County Community College Assessment Project:

- 1. Review the following resource list. It represents a wealth of factual information, curriculum development assistance, and technical assistance.
- 2. Contact Westmoreland County Community College Project Director.

## RESOURCES

### TEXTBOOKS

The following is a list of textbooks useful for a program in Mining Technology. The list is not conclusive, and the educator should avail himself of suggestions made by instructors for mining courses.

1. Adams, James E., *Electrical Principles and Practices*, 2nd ed. McGraw-Hill Book Company, 1973.
2. Cassidy, Samuel M., ed., *Elements of Practical Coal Mining*. Baltimore, Maryland: Port City Press, Inc., 1973.
3. *Coal Mining Reference Book*, 4th ed., revised. Kentucky Mining Institute, 1973.
4. *Coal Preparation*. Seely W. Mudd Series. Baltimore, Maryland: Port City Press, Inc., 1968.
5. Cummins, Arthur B. and Given, Ivan A., *SME Mining Engineering Handbook*, vol. 1. Seeley W. Mudd Series. Baltimore, Maryland: Port City Press, 1973.
6. Cummins, Arthur B. and Given, Ivan A., *SME Mining Engineering Handbook*, vol. 2. Seeley W. Mudd Series. Baltimore, Maryland: Port City Press, 1973.
7. Doyle, William S., *Strip Mining of Coal*, Environmental Solutions. Noyes Data Corporation, 1976.
8. Drooyan, Irving, Hadel, Walter, and Carico, Charles C., *Essentials of Trigonometry*. MacMillan Company, 1971.
9. Eckles, Robert W., Carmichael, Ronald L., and Sarciet, Bernard R., *Supervisory Management, A Short Course in Supervision*. Business Administration Series. Wiley Professional Development Programs. John Wiley & Sons, Inc., 1975.
10. Jones, Donald C. and Hunt, Joseph W., *Coal Mining*, vol. 1 3rd ed. Pennsylvania State College, 1952.
11. Jones, Donald C. and Hunt, Joseph W., *Coal Mining*, vol. 2 3rd ed. Pennsylvania State College, 1952.
12. Koontz, Harold and O'Donnell, Cyril, *Essentials of Management*. McGraw-Hill, Inc., 1974.
13. Leet, L. Don and Judson, Sheldon, *Physical Geology*, 4th ed. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971.
14. Lewis, Robert S., E.M. and Clark, George B., *Elements of Mining*, 3rd ed. John Wiley & Sons, Inc., 1964.
15. Lial, Margaret L. and Miller, Charles D., *Beginning Algebra*, 2nd ed. Glenview, Illinois: Scott, Foresman and Company, 1976.
16. *Mobile Hydraulics Manual M-2990*. Troy, Michigan: Sperry Rand Corporation, 1967.
17. Moffit, Francis H. and Bouchard, Harry, *Surveying*, 6th ed. New York: Intext Publishers, 1975.
18. Parker, Harry, M.S., *Simplified Mechanics and Strength of Materials*, 2nd ed. John Wiley & Sons, Inc., 1961.
19. Pfeider, Eugene P., ed., *Surface Mining*. Seeley W. Mudd Series. New York, 1968, reprinted, York, Pa.: Maple Press Company, 1972.
20. *Study Guide Series*, vol.'s 1-11. Mining Extension Service, College of Mineral and Energy Resources, West Virginia University, Morgantown, W. Va., June, 1975.
21. *Underground Mining*, vol. 1: Introduction and Development. Joy Manufacturing Company, 1972.

### LAWS AND CONTRACTS

The listed laws and contracts should be used as supplemented reading. Appropriate state mining laws should be substituted for Item One, and care should be used in utilizing current contracts and current Federal Regulations.

1. Department of Environmental Resources, *Bituminous Coal Mining Laws of Pennsylvania for Underground Mines*. Harrisburg, Pennsylvania, 1961.
2. *National Bituminous Coal Wage Agreement of 1974*. United Mine Workers of America, Washington: Allied Printing Trade Council, 1974.
3. *National Coal Mine Construction Agreement of 1974*. Washington: Contract between Association of Bituminous Contractors, Inc., and the United Mine Workers of America.
4. U.S. Congress. *Federal Coal Mine Health and Safety Act of 1969*, Pub. L. 91-173, 91st Cong., 2917, 1969.
5. U.S. Department of the Interior, *Mining Enforcement and Safety Administration, Excerpts from Code of Federal Regulations, Title 30*. Washington, D.C.: Government Printing Office, 1975.

### INSTRUCTIONAL MATERIAL SOURCES

The following represent a list of instructional material sources identified during Mining Technology Research. As with the textbooks, the list is not conclusive.

1. Caterpillar Service Training Materials (catalogue). Caterpillar Tractor Company.
2. *Electrical Qualification, Course Elements, Instructor's Outline*, U.S. Department of the Interior, Mining Enforcement and Safety Administration, Pittsburgh Training Center, Pittsburgh, Pa.
3. *Jeffrey Mining Machinery Division, Training Aids Price List*. Jeffrey Dresser, Inc., Columbus, Ohio, 1975.
4. *Lee-Norse Training System*. (catalogue) Charleroi, Pennsylvania: Lee-Norse, Ingersoll-Rand, 1975.
5. *Mitrex* (catalogue of products) R.D. 1 Box 197, Belle Vernon, Pa. 15012
6. *Training Material Directory*. Franklin, Pennsylvania: Joy Manufacturing Company, 1975.
7. U.S. Department of the Interior, Bureau of Mines. *Motion-Picture Films of the Bureau of Mines*, 1976.
8. U.S. Department of the Interior, Mining Enforcement and Safety Administration, *Coal Mine Safety Inspection Manual for Underground Mines*.
9. U.S. Department of the Interior, Mining Enforcement and Safety Administration, *Coal Mine Health and Safety, Coal Mine Safety Electrical Inspection Manual for Underground Coal Mines, Surface Coal Mines and Surface Work Areas of Underground Coal Mines*, Washington, D.C.: Government Printing Office, 1973.
10. U.S. Department of the Interior, Mining Enforcement and Safety Administration. *Motion Pictures*.
11. *Vocational Industrial Education Service, Mine Maintenance*. Charleston, West Virginia State Board of Education, Bureau of Vocational, Technical and Adult Education, 1967.
12. U.S. Department of the Interior, Mining Enforcement and Safety Administration. *Education and Training Programs and Materials*, 1975.

## PERIODICALS

Subscription to the following periodicals will provide "state of the art" information about mining. Subscription information is available from the publishers; other periodicals may also provide information.

1. American Mining Congress, Mining Congress Journal, Vol. 62, No. 7, July, 1976.
2. Coal Age, Vol. 81, No. 1, January, 1976, McGraw-Hill.
3. Engineering and Mining Journal, Vol. 177, No. 1, January, 1976, McGraw-Hill.
4. MESA, The Magazine of Mining Health & Safety, March/April, 1976. Office of Information of the Mining Enforcement and Safety Administration.
5. United Mine Workers Journal, 1976 Issues. United Mine Workers, Indianapolis, Ind.

## OTHER REFERENCES

These references, along with the previously mentioned textbooks, laws and contracts, instructional material sources, and periodicals, supplied the written data for this report.

1. Althouse, Ronald, Work, Safety, and Life Style among Southern Appalachian Coal Miners, A Survey of the Men of Standard Mines. Office of Research and Development, Division of Social and Economic Development, Appalachian Center, Morgantown: West Virginia University, 1974.
2. Coal for the 70's. A Pennsylvania Action Conference. Harrisburg, 1974.
3. Christenson, C. L. and Andrews, W. H., Manpower and Technology in Bituminous Coal Mining, 1956-1970. Bloomington, Indiana: Indiana University, 1970.
4. Cooper, Franklin D., The Mineral Industry of Pennsylvania in 1972. Commonwealth of Pennsylvania, Department of Environmental Resources: U.S. Government Printing Office, 1975.
5. Davies, Ivor K., Competency Based Learning: Technology, Management and Design. McGraw-Hill Book Company, 1973.

Most of the information for this report was gathered during the author's personal contact with Educational Institutions, Labor Unions, Mining Equipment Manufacturers, Government agencies, Coal Companies and their associations, and groups and companies classified as "other". Following is a list of those contacted.

## EDUCATIONAL INSTITUTIONS

Admiral Perry Vo-Tech School, Ebensburg, Pennsylvania  
Beckley College, Beckley, West Virginia  
Belmont Technical College, St. Clairsville, Ohio  
College of Eastern Utah, Price, Utah  
Eastern Arizona College  
Elders Ridge, Penn State University, Saltsburg, Pennsylvania  
Fairmont State College, Fairmont, West Virginia  
Florence Mine Machinery Operations Training Program, Seward, Pennsylvania  
Illinois Eastern Junior College, Wabash Valley College, Illinois

Indiana University of Pennsylvania, Indiana, Pennsylvania  
Madisonville Community College, Madisonville, Kentucky  
Penn State University, Fayette Campus, Uniontown, Pennsylvania  
Penn State University, Mining Engineering Department, State College, Pennsylvania  
Pikeville College, Pikeville, Kentucky  
Rend Lake College, Ina, Illinois  
Sheridan College  
Southeastern Illinois College, Harrisburg, Illinois  
Southern Illinois University, Carbondale, Illinois  
University of West Virginia, Morgantown, West Virginia  
Waynesburg College, Waynesburg, Pennsylvania  
West Virginia Institute of Technology, Montgomery, West Virginia  
West Virginia Wesleyan College, Buckhannon, West Virginia  
Western Wyoming College, Rock Spring, Wyoming

## LABOR

United Mine Workers of America (UMWA), Greensburg, Pennsylvania, Pittsburgh, Pennsylvania, Washington, D.C.

## MINING EQUIPMENT MANUFACTURERS

Jeffrey Dresser Manufacturing Co., Columbus, Ohio  
Joy Manufacturing Center, Franklin, Pennsylvania  
Lee-Norse, Ingersoll-Rand, Charleroi, Pennsylvania

## GOVERNMENT AGENCIES

Mine Enforcement and Safety Administration (MESA), Pittsburgh, Pennsylvania, Beckley, West Virginia  
Department of Environmental Resources, Office of Deep Mine Safety, Uniontown, Pennsylvania  
Pennsylvania Department of Environmental Resources, (Division of Solid Waste), Greensburg, Pennsylvania  
U.S. Bureau of Mines, Pittsburgh, Pennsylvania, Washington D.C.

## COAL COMPANIES AND ASSOCIATIONS

Bituminous Coal Operators Association, Washington, D.C.  
Central Pennsylvania Coal Operators Association, Ebensburg, Pennsylvania  
Consolidation Coal Company (Consol), Pittsburgh, Pennsylvania  
Eastern Associated Coal Co., Pittsburgh, Pennsylvania, Beckley, West Virginia  
Eidemiller Enterprises, Inc., Greensburg, Pennsylvania  
The Florence Mining Company, Seward, Pennsylvania  
Mears Coal Company, Dixonville, Pennsylvania  
Republic Steel, Uniontown, Pennsylvania  
South Union Coal Company, Greensburg, Pennsylvania  
U.S. Steel, Cumberland Coal Division, Waynesburg, Pennsylvania

## OTHERS

The Bendix Corporation, Ann Arbor, Michigan  
Bituminous Coal Research Incorporated, Monroeville, Pennsylvania  
HRB-Singer Co., State College, Pennsylvania  
McDonnell Douglas Corporation, St. Louis, Missouri  
Washington County Office of Manpower, Washington, Pennsylvania



## United States Department of the Interior

MINING ENFORCEMENT AND SAFETY ADMINISTRATION

4015 WILSON BOULEVARD

ARLINGTON, VIRGINIA 22203

December 13, 1976

Mr. H. Mark Jones  
Special Projects Coordinator  
Westmoreland County Community College  
College Station  
Youngwood, Pennsylvania 15697

Dear Mr. Jones:

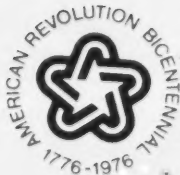
Thank you for giving us the opportunity to review the draft report of recommendations to two-year post-secondary institutions relative to mining technology education.

In our opinion the material presented is well organized, presented in a clear, simple but effective manner, and should represent a very valuable tool for those educators in mining areas who are contemplating the initiation of mining technology programs.

Please send us a copy of the document when it is completed and let us know how we can get additional copies for use by our field personnel.

Sincerely yours,

Donald P. Schlick  
Acting Assistant Administrator-  
Education and Training





MOUNTAIN EMPIRE COMMUNITY COLLEGE  
DRAWER 700, BIG STONE GAP, VIRGINIA 24219  
TELEPHONE: 703/523-2400

November 18, 1976

Mr. H. Mark Jones  
Special Products Coordinator  
Westmoreland County Community College  
Central Campus, College Station  
Youngwood, Pennsylvania 15697

Dear Mr. Jones:

I have just reviewed your publication Mining Technology: An Assessment Study for Educational Institutions Potential Involvement in Servicing the Mining Industry. I was quite impressed by this document.

I set up our Mining Technology Program and learned the mining industry the hard way -- through trial and error. This document two years ago would have been a good introduction.

It was good to talk to you at the Energy Conference and best of luck to you in the future.

Sincerely,

Revonda Williams  
Assistant to the President and  
Director, Mining Technology

RW/dp

# CONSOLIDATION COAL COMPANY

INCORPORATED

ONE CLIVER PLAZA

PITTSBURGH, PENNSYLVANIA 15222

TELEPHONE 412/281-8700

October 22, 1976

Mr. H. Mark Jones  
Special Projects Coordinator  
Institutional Development  
Westmoreland County Community College  
Youngwood, Pennsylvania 15697

Dear Mr. Jones:

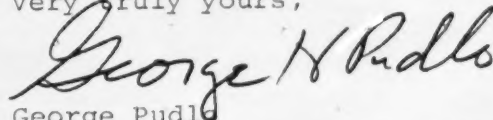
I have reviewed your draft report of recommendations for two-year post-secondary institutions interested in mining technology education. I feel you have done a thorough job in your recommendations.

In Consol, we are particularly interested in your recommendations regarding Associate Degree programs, particularly in production and mine maintenance supervision. I think it is more important to concentrate on these programs rather than on programs such as orientation training. We have inhouse capability to do such programs. The courses and course descriptions represent a particularly useful background for potential production and maintenance supervisors. Our ability to successfully eliminate the problem areas of a decline in productivity and our ability to safely mine coal will, to a large degree, depend on quality persons entering our industry.

In regards to an advisory board, I would like to recommend Mr. John Winemiller, Manager of Industrial and Employee Relations for our Eastern Region. He is in a decision making position that lends itself to an effective working relationship between industry and additional institutions.

If I can be of additional assistance, please do not hesitate to call as I am interested in what you are doing.

Very truly yours,



George Pudl  
Manager of Employee Development

GHP:mph

cc: J. L. Winemiller



"TRAINING  
PROGRAM  
DEVELOPMENT"

October 20, 1976

H. Mark Jones  
Westmoreland County Community College  
College Station  
Youngwood, PA 15697

Dear Mark:

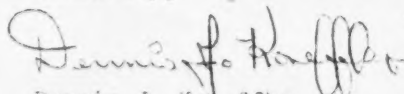
Concerning our conversation yesterday, I have thoroughly read your report which presents recommendations to two-year post-secondary institutions interested in Mining Technology education. I feel the information is well researched and presented.

The report is an excellent beginning point for anyone contemplating a Mining Technology program. On many occasions in the past such a document would have been of immense value in my business dealings. In the future, I hope that I may feel free to recommend its usage. Once the report is published please let me know how I might obtain a few copies to have available when working with perspective clients.

On the attached page I've taken the liberty to list a few recommendations on content which you may wish to consider. I sincerely hope that I have been helpful.

I thank you for including MITREX under your listing of Instructional Material Sources. In the near future you will be receiving a copy of the illustration of our Basic Electricity Trainer as well as brochures on the products and services which we offer to the mining industry.

Sincerely,

  
Dennis J. Koneffko

BASIC  
MANAGEMENT  
PROGRAM



## United States Steel Corporation

General Management Development



MANAGER  
DEVELOPMENT  
PROGRAM

November 9, 1976

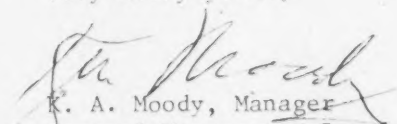
H. Mark Jones  
Special Products Coordinator  
Central Campus  
Westmoreland County Community College  
Youngwood, Pennsylvania 15697

Dear Mark:

Thank you for sharing your assessment study "Mining Technology" with me.

I thought it would be helpful to any educational institution seeking to serve the mining industry, and have turned it over to my colleague, Bill Etheredge, who heads up our training services for our Coal operations.

Very truly yours,

  
K. A. Moody, Manager  
General Management Development

bp  
cc: W. O. Etheredge